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UNIVERSITY OF ALBERTA

PORTABLE WORD PROCESSORS AND GRADE 8 WRITING: AN EXPLORATORY CASE STUDY

BY

CAMERON C. FAHLMAN

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Master of Education.

DEPARTMENT OF SECONDARY EDUCATION

Edmonton, Alberta
Fall, 1993

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ISBN 0-315-88298-0

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ACKNOWLEDGEMENTS

The author wishes to express his sincere appreciation to all who made this study possible:

To Dr. John E. Oster, chairman of the supervisory committee, for his tireless guidance, encouragement, and support;

To Dr. Margaret Iveson for her constant encouragement over many years;

To Dr. Roberta McKay for her valuable assistance on my committee;

To the students, classroom teachers, and school administration at "St. Ethos" Junior High School for their unbridled enthusiasm, encouragement, and accommodation at all stages of this study;

To Glen Kirkland, Eugene Kozack, Ron Schlender, and Jerry Wouk for their assistance and encouragement;

To Edmonton Catholic Schools for their permission to carry out this study;

To Edmonton Public Schools for granting me a sabbatical year followed by an an additional year's leave-of-absence;

To Edmonton Public School Local #37, ATA, for their award of the Murray Jampolsky Scholarship which assisted my return to university;

To my parents Alberta and Lila Fahlman who taught me to persevere.

To my family: my daughter Amanda-Lynn, my son Christopher, and especially to my wife Carla-Joan, for their tested patience, constant faith, and loving support.

ABSTRACT

The purpose of this study was to contribute to our understanding of the nature and meaning of the experience for students and teachers using portable word processors in Grade 8 Language Arts, Math, Science, and Social Studies. The focus was on describing how the machines were being used and their impact on the teaching and learning which occurred. I sought to learn, through the students' and teachers' reflections and behaviors, what it was like for them to use portable word processors and, thus, how teachers can better use such a writing tool in their classrooms.

I observed the students and teachers over nine weeks. I sat in on all four subjects with both of the classes which participated in the study. Data collection consisted of three strategies: observation, questionnaire, and interview. All of the data were compiled in a discourse which explored aspects of process writing, the impact of the technology, and the issues arising from using the technology. The presentation of the data attempts to capture as much as possible the voices and lived-world experiences of the participants.

The nature of the grade eight students experiences with using portable word processors was generally positive. The presence of a portable word processor for each student appeared to benefit students in a number of ways: the machine's design provided students with a word processing tool which was constantly available; as a word processor, it inherently accommodated and facilitated the recursiveness of process writing; its portability assisted with the acts of gathering information and collaboration; it contributed to positive student attitudes involving revision and feedback; and its built-in spelling checker impacted positively on word choice.

The presence of portable word processors in classrooms may prompt teachers to assess their understandings about writing, to rethink the types of writing they assign, to reflect on their teaching methodologies, and to lobby for the support necessary to facilitate such adaptation and change.

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CHAPTER 1
INTRODUCTION

Background to the Study

Over the last decade, tabletop computers have become fairly well established in Alberta schools. Networked in computer labs, placed as stand-alone stations in classrooms, or trundled from one location to another atop mobile carts, tabletop computers have made their presence known to both students and teachers. With the advent of the new technology, a new literacy has been spawned: students in increasing numbers are entering our secondary schools knowing how to keyboard, and even teachers such as myself who entered the decade of the Eighties thinking that a "cursor" was someone who was both profane and weak at spelling have entered the Nineties with a whole host of lesson plans and assignments, tests and class records stored on computer.

In the high schools where I have taught, increasingly computers have been used to word process the writing of students: fewer assignments are handed in which have been written out by hand or typewritten. Even short writing tasks and writing usually scribbled with a pen such as brainstorming have been appearing in wordprocessed form.

During the last decade as well, numerous studies have informed teaching practice about the effect of tabletops computers and word processing programs. Of particular interest to me as a senior high English teacher have been those studies which have examined how the technology has affected students' writing processes. However, owing to the nature of tabletop computers which, for the most part, are situated side by side in computing stations, most of these studies have been situated in computer labs rather than in the natural setting of the typical classroom.

Several studies have also commented on one frustrating aspect of using these computers to assist student learning: the availability of the machines. Such availability (or, rather, unavailability) seems to be at the moment a significant concern for increasing numbers of students and teachers jockeying for time in computer labs; English teachers are wrestling with teachers of social studies who are elbowing science teachers for machine access.

Enter the portable word processor. Also known as the laptop computer or the personal electronic notebook, this piece of technology has been appearing increasingly in various elementary and secondary classrooms throughout Alberta. By its very design, the portable word processor can go wherever the student goes. Its portability means that the technology can accompany the student wherever he or she ventures. Instead of the meeting

of writing and technology taking place in a computer lab, such integration can take place within the natural settings of various writing environments including subject area classrooms and libraries.

As well, the portable word processor's design promises to diminish the concern with machine availability: it is constantly accessible to students. No longer need students tap haltingly on the computer lab door seeking entrance to its sanctum. No longer do teachers have to negotiate time in the lab with a host of other colleagues bent on securing similar time for their students. Instead of word processing being a tool which might be integrated into the teaching-learning situation of secondary classrooms some of the time, it is now possible to access this technology continually.

Many educators maintain that as a technology the computer will not be denied: in all probability, it will continue to make its presence known in our classrooms at an increasing rate. In particular, as it becomes increasingly affordable the portable word processor as a tool to assist student learning stands to impact significantly on both the learning and the teaching which are occurring in the classroom. This provokes a major concern: how can teachers best take advantage of portable word processing technology to assist their students' learning?

Such a question certainly was the farthest thing from my mind when I returned to the University of Alberta to work on my Masters Degree in July of 1990. My experience with word processing had been such that I might have described my ability in using the technology as being "proficient." Since I first learned where the "on" switch was on an Apple II Plus in 1984 , I had progressed with my computer literacy to the point where I was recording my marks, assignments, writing models and tests for my English students onto a Macintosh SE. I prided myself with being able to underline, italicize and make bold a variety of fonts and sizes of text. Indeed, I could state with confidence, "I know a mouse from a handsaw."

However, if someone were to ask me about how word processing had been affecting how I wrote, I would have had to hesitate a moment or two before answering. And if that same questioner had asked me how the technology had been affecting how my students wrote, the hesitation would have been far longer. At the time that I returned to university, I had never taken any of my students into a computer lab, and as to what exactly my students were doing with word processing between a writing task being assigned and handed in I was blatantly ignorant.

Like many high school teachers, I was aware that increasing numbers of students were coming into the senior grades with increasing proficiency at word processing, and I had seen the growing amounts of writing being handed in which were being word

processed. On occasion I would even see students bring to class hardcopies of their writing-in-process. If asked how the advent of the word processor had been affecting my teaching practice, I would have pointed out that I was "permitting" students to hand in work that had been word processed rather than typed. I would have added somberly that, just as I expected handwritten work to have been proofread, I expected such things as typos to have been corrected. There was not much more I could add: end of discussion because of end of awareness.

That is not to say that I had never wanted to take my students into a computer lab. Like many urban senior high schools in Alberta, the two large schools where I had most recently been teaching boasted two computer labs, and my business education colleagues were more than eager to assist students and teachers with acquiring improved computer literacy. However, time in such computer labs was (and still is) more often than not fully booked for computer course offerings, and access to the machines for students in the core subjects ranged from minimal to non-existent.

Almost by default, then, I had preferred to stay within the domains of our English classroom and help students with their writing. Things seemed to go quite well: "writing as a process" was the credo of the day; I was giving class time for writing, including brainstorming, talk, peer editing, more talk, and revision; I was spending period after period going from student to student, offering feedback and instruction as needed. I certainly felt that I understood much of what I needed to know to assist my students in their writing. And yet, for all my apparently successful teaching, I remained blissfully ignorant of the potential offered by the use of word processing technologies to assist student writing and of the strategies and processes which such machines both demanded and encouraged. The word processor as a writing tool for my students was something out there down the hallway from our classroom. It was something that a few students were doing to their writing but not during our time together as an English class.

What made me begin to think about opening an eye and looking at how students were using word processors as a tool for writing were several negative comments I began hearing from colleagues (and half-believing myself) about the phenomenon: using a word processing program with built-in spelling checkers was a "shortcut," something bordering on the immoral or the unethical, perhaps even the mildly criminal; producing hardcopies of wordprocessed text was depriving students of the opportunity to write things out by longhand, stealing from them the fruit of their sore digits; revising their work using the cut and paste functions was making obsolete the structured outline, resulting in writing that seemed to have crawled out of the depths of Chaos. The perceptions were that somehow the effort of having to reach for a bound volume of a Concise Oxford or a Webster's and

struggle with its pages was good for the soul, the arabesque sweep of one's penmanship helped define one's character, and the outlining of one's work before writing was an action as sacrosanct as the Divine Right of Kings. These and other myths about writing made me begin to laugh; nonetheless, I felt I had to learn more about what indeed was the impact of such technology.

I had been feeling guilty about my own hesitations with taking a classroom of students into a computer lab for the purpose of word processing. While I knew I had indeed helped them with their writing in the setting of our English classroom, I felt I could and should be doing more, such as shouldering my way into computing labs and assisting my students in using this tool, and being louder in my voicing the need for writing labs for our students who enter Grade 10 knowing how to word process only to be denied the opportunity to continue improving their use of computers for writing. Above all else, I felt I should be preparing for this quest by gaining a better understanding about how students were using word processing in their classrooms.

The final nail in the coffin of my complacency was hammered home toward the end of 1991. I read an article written by fellow teacher Ron Schlender in The ATA Magazine describing the experiences of students and teachers in an Edmonton Catholic junior high school using portable word processors to facilitate their writing. From all appearances, it seemed that the students at the school were engaging in something out of the ordinary insofar as word processing their writing was concerned. I immediately felt I had to learn more about how students were using this already-present technology and its impact on student writing. I did not want to return from my educational leave without having gained these insights.

The rest of the story is this study.

Statement of the Purpose

The main purpose of my study has been to contribute to our understanding of what it means to students to engage in the use of portable word processing in a number of different core subjects and learning situations, and what it means to teachers to teach in an environment in which such a technology is being used.

Research Questions

In order to achieve the purpose of the study, the following research questions guided its design and procedures:

1. What is the nature and meaning of the experience for students and teachers using portable word processors for writing activities in the particular grade eight classrooms being studied?
2. What insights into the writing of grade eight students can be gained from the behaviors and comments of students using portable word processors in their core subjects?
3. What sort of impact has the presence of a portable word processor had on the teaching/learning situations at a particular school?
4. How does the experience of using portable word processors in the learning environments of the particular grade eight classrooms being studied compare with what has been observed in other studies into the use of word processing in the writing processes of junior high school students?
5. What factors contribute to effective use of portable word processing, and what do we need to provide in the core subject classrooms to assist students in using the technology effectively?

The Type of Study

To fulfill the purpose of my study and find answers to my research questions, I chose to conduct a naturalistic case study which sought to understand the meaning of the experience for students and teachers using this particular technology. As Patton (1985) states, a naturalistic study "is an effort to understand situations in their uniqueness as part of a particular text and the interactions there... to understand what it means for participants to be in that setting" (p. 1). To this end, my study has focussed on discovery, insight, and understanding from the perspectives of those being studied.

The study was naturalistic in the sense that I entered a natural setting, the classroom, in an effort to gain an understanding of the experience of students writing with portable word processors in their learning environments. I observed students and teachers where they were and as they went about their normal routines. The objective was to gain an understanding of the way of life (here, the act of writing as mediated by portable word processing technology) in the particular classrooms being observed. I sought to learn what it is like for students to use a portable word processor for their writing and for teachers to instruct with this technology accompanying the student in those grade eight classrooms.

Being a naturalistic inquiry, this investigation permitted a degree of flexibility which is crucial to conducting an exploratory case study. As I intended that my study would be exploring something about which at the time little was known (how grade eight students

and teachers interpret and use the portable word processor as a tool for writing), it was important that I chose a study type which permitted flexibility. The data gathered by one part of a study may reveal to an investigator a direction of inquiry which may not have been anticipated in the initial design of the study.

The study was also exploratory in that it sought to answer the question "What is it like for grade eight core subject students and teachers to use a portable word processor during the school day in grade eight classrooms to achieve the objectives of the grade eight curriculum?"

I chose to conduct an exploratory study because I felt it would assist me in gaining a more holistic understanding of this encounter of student and machine. While I was watchful of certain student behaviors involving the use of word processing which have been described in the research literature, I sought to remain open to whatever events were occurring in the learning/writing situations at the study site. In other words, while I began my inquiry with a number of questions which reflected my pre-understanding (it is not possible to understand something which is not already understood to some degree), I intended for my study to be as open-ended as possible so that both the "essence" and the "big picture" of the encounter could be gathered and conveyed to the reader.

Delimitations

I set certain parameters to make the study manageable:

1. The study was restricted to one junior high school in the west end of Edmonton. Observation in the study was restricted to two classes, identified in this study as 8X and 8Y, in which all students have purchased Tandy WP-2 portable word processors for use in their various courses. I observed students in the setting of four core subject areas (language arts, math, science, and social studies) and one complementary subject (computers).
2. The number of participants included eight student key informants as well as the two grade eight classes in which they are members and seven teachers including the school's principal teacher.
3. The study was conducted over nine weeks, from the third week in April to the third week in June, 1992.

Limitations

The following factors limit generalization from the study's findings:

1. Limiting the study to one school and observing two classes over approximately six weeks of the study limits the possibilities of making generalized discoveries.
2. The particular machine used by students during this study is the Tandy WP-2 Portable Word Processor. The use of machines with different features might elicit somewhat different responses from students and teachers.
3. The students using Tandy WP-2 Portable Word Processors in this study own them. Student attitudes towards portable word processing, towards utilization of a portable word processor and even towards writing may differ from those voiced in this study if the machines are school-purchased.
4. Prior to the study, the students observed had been experiencing use of portable word processors for almost eight months. Students observed with less or greater experience may offer responses different from those voiced at the time of this study.
5. The students observed demonstrated different degrees of proficiency with their portable word processors. Students who are more or less competent may demonstrate behaviors different from what was observed.
6. The researcher made some of his observation while standing behind or beside certain students; it is not known how the presence of the researcher affected students' behavior and responses.
7. The investigator can not observe and inquire about everything which is occurring during a students' engagement with a portable word processor.
8. The value of the data is limited by the observational and interpretive abilities of the researcher.
9. The possibility of bias or lack of skill of the interviewer/observer does exist.

Assumptions

The following assumptions characterize this study:

1. Students at the grade eight level were sufficiently mature to be able to articulate their perceptions of, and experiences with, using a portable word processor to assist writing and learning.
2. Students at this level were comfortable and sufficiently mature discussing with peers and the investigator their experiences with using portable word processing.
3. Teachers in junior high were sufficiently reflective and interested in the outcomes of the study to be able and willing to contribute meaningful data.

4. Teachers in junior high were comfortable discussing with peers and the investigator their experiences and insights concerning the integration of portable word processing into the grade eight curriculum.
5. The respondents were direct and open in replying to any questions asked in the context of informal talk, formal interview, written correspondence, and questionnaire.
6. The researcher was capable of gathering accurate and meaningful data.
7. The perceptions of students and teachers were adequately gathered and interpreted using the methods designed for this study.
8. Although the presence of the researcher had some effect on the students' behavior and responses, the students continued to function in a reasonably normal manner.
9. The numbers of participants and duration of the study were sufficient to answer the research questions adequately.

Significance of the Study

This particular study has sought to make a significant and timely contribution to the knowledge base and practice of education by building on the research strategies of other investigators. It joins a number of studies (for example, Mathieu, 1989; Edwards and Walker, 1990) which feature a multiplicity of voices. I have made prominent the voices and perspectives of both students and teachers as well as the voice of the investigator throughout my thesis.

The research methodologies adopted by studies which have captured the voices of participants have done so frequently by means of an isolative protocol: whether by means of questionnaire, interview, journal writing and the like, participants have responded individually. This investigation has included a less-frequently-used protocol in which data have been gathered from conversations between teachers.

While much has been written about the experience of using tabletop computers to assist writing, relatively little has been written concerning the use of portable word processors in this manner. This study joins the growing number of studies which have focused on the use of portable word processors by students in the act of writing.

Prior to 1985, many of the studies on word processors and student writing were undertaken by researchers whose familiarity with the area of computers was strong but whose familiarity with the area of writing was fairly limited. This particular study joins the body of research done by teacher-researchers (for example, Carter, 1990; Crawford, 1989;

Herrmann, 1987a, 1987b; Mathieu, 1989; Paszek, 1991) whose backgrounds include a strong familiarity with student engagement in the act of writing.

In addition to the above aspects of my study, I propose that it is also timely. As some school jurisdictions embrace the use of portable word processors and others contemplate the purchase of such technology, now seems an appropriate time to examine the merits and limitations of this technology, especially as it concerns students' writing. Will teaching and learning in schools be technology-driven or pedagogy-driven? What does one need to know about computers and what does one need to know about writing and learning and students in order to use portable word processors effectively?

The audience whom I seek to inform includes both classroom teachers and educational decision-makers. Many teachers in subject areas where, traditionally, there has been little emphasis on writing are seeking information which will inform their practice: in addition to having their students engage in the familiar act of note-taking, such teachers are looking for ways in which their students might engage in writing to learn. In the past, such an emphasis has been called "writing across the curriculum."

As well I seek to inform the reader about some of the possible benefits and detriments which may be associated with the employment of portable word processing in a junior high learning environment as demonstrated by the particular case study. Many school jurisdictions are continually assessing and redefining the roles which technology is playing or might play in student learning. Some are asking, "What sorts of learning are we expecting technologies to assist?" "How might certain technologies assist student learning?" and "Are we buying something based on hyped popularism or based on informed reflection?" Such school districts are seeking answers concerning possible directions they might head in acquiring computer technology. By portraying the lived-experience of those who have used the technology in the learning environment of the classroom, I intend that my study will provide information which will assist these two interest groups in their decision-making.

Whenever I have thought it to be helpful to my reader, I have provided a detailed description of the characteristics of the particular machine used by students in this study--the Tandy WP-2 Portable Word processor. My intent has been to provide a clear and thorough description of the type of machine used by participants in this study, including their assessment of the apparent strengths and weaknesses of its design and features. As new makes and models of portable word processors, electronic notebooks, and laptop computers enter the education and business markets, students may utilize these newer machines in a manner different from the ways in which those participating in this study had been been using the WP-2.

In order to increase the significance of this study, I have attempted to provide a full, clear description of the context. As frequently as possible, I disclose the type of writing (for example, story) being discussed by participants. As well, I frequently include mention of the tool being used by writers for a particular stage of a writing process (for example, using pen and paper for brainstorming). Further, I provide detail to assist the reader in determining more fully what is occurring when a student is engaging in composing or revising his or her text (for example, whether the student composing at the computer is entering text prewritten with pen and paper, or whether the student is making revisions to text printed from the WP-2 as hardcopy). Finally, depending on the length of a response I indicate whenever suitable the particular context in which it has been made (for example, offered during a structured interview).

A final way in which my study may be considered significant is the positive effect it seems to have had on the participants involved. Prior to beginning the study, I proposed that questionnaire and interview might provide means by which participants could reflectively explore and articulate their opinions, observations, and insights. Just as one might write for discovery, it was my hope that through the acts of writing and talk my respondents might create new understandings for themselves.

As well, in designing my study I speculated that interviewing might also have positive long-term effects for respondents: it may give them an interest in pursuing certain actions (for example, a student pursuing writing with a renewed interest or a teacher undertaking action research).

CHAPTER 2
REVIEW OF THE RESEARCH LITERATURE

Chapter Overview

This chapter provides the research background against which I can compare the data gathered in my study in order to explore one of my research questions:

How does the experience of using portable word processors in the learning environments of the particular grade eight classrooms being studied compare with what has been observed in other studies into the use of word processing in the writing processes of junior high school students?

Many education researchers have been looking into how students are using word processors as a tool for writing and what are the effects of such technology on student writing. Some researchers have examined its effects on writing in terms of product. Others have examined the effect of word processing on writing processes, focusing mostly on how the technology is affecting the composing as well as the revision and editing processes.

Several researchers have examined the role of hardcopy in student writing and the importance of printer availability. Some recent studies have also been looking more closely at the types of writing being attempted with the technology and the types that seem better suited to pen and paper. Yet another direction researchers have looked is the effect of word processing on student learning and the implications of such findings for teaching. As well, researchers have examined how teacher orientation to the technology and understanding about writing affects students' successful utilization of word processors. Many of these studies have also contributed to an increased understanding of the public nature of word processing and the effect that the "community of writers," which utilization of the technology seems to foster, has on authorship.

Researchers have also explored several issues which have arisen over the last several years concerning the use of computers for writing. They have looked at the impact on student writing of accessibility and portability, of spelling checkers and style analyzers, and of computer-assisted instruction. As well, they have examined the effect of word processors on writing quality and students' perceptions of their writing, and the effect of the technology on individualized instruction.

This chapter examines what has been observed about the use of both tabletop and portable word processors and the apparent impact of such technologies on student writing and on teaching.

The Effect of Word Processing on Elements of Writing Processes

Examining the effect of word processing on the act of writing is not an easy task: the recursive nature of the act of writing makes it difficult to study because the stages tend to flow one into the other (Mathieu, 1989). Still, examining how students create and work with their wordprocessed text is important, for it provides us with a window on how people "connect" with this technology. Mehan (1989) observed:

> [A] microcomputer in a classroom is a social practice and not a technology. The crucial ingredient is people's experience with the machine, not its "inherent" features. It is what people [choose] to do with the machine, not the machine itself that makes a difference.

Many researchers have contended that word processing and the teaching of writing as process are a good match. Montague (1990) maintained that a process-based approach to writing instruction for school-aged children as described by Donald Graves (1983) and Lucy Calkins (1986) seemed particularly well-suited to computer-assisted composing. Lutz (1987) viewed a word processor as an enabling device, in that it encouraged writers not to be committed to their first writing draft. Aschauer and White (1984) contended that producing text on a word processor is more tentative and noncommittal than producing text with pen and paper, and that this in turn encourages the writer to experiment with words.

Blankenbaker and Hamstra (1989) maintained that this technology helps students undergoing a shift in paradigm:

> ... the word processor becomes a mirror of the writing process, making writing less mysterious. It enhances writers' interactions with their own ideas and helps them see their texts as writers and readers. This fusing of the writing process and the word processor helps the writer over the first hurdle--the notion that writing is a magical craft known only to the experts. (p. 58)

The Effect on Pre-Writing

Pre-writing strategies encourage writers to collect, explore, and focus ideas (Blankenbaker and Hamstra, 1989). They may do so by means of brainstorming, mind mapping, free-writing, journal entries and recording research data.

Some researchers maintained that brainstorming can be effectively managed and utilized on a word processor. Blankenbaker and Hamstra (1989) contended that word processing lends itself to the creation of lists of ideas. Aschauer and White (1984) concurred, contending that the gap between brainstorming and finished product can be narrowed by the "windowing" feature on some word processing programs.

Seemingly less successful for the word processor is mind mapping or clustering. Blankenbaker and Hamstra (1989) described this idea-collecting activity as "a noncomputer

heuristic that requires writers to place the subject or topic under consideration in the center of the page to expand it with supporting incidents or ideas on the extensions" (p. 51). Reynolds and Hart (1990), in their study of fourth-grade private school students, found that stories written by those students using mind maps scored higher for organization than those stories which were assisted by brainstorming and outlining; however, while they described that some of the students composed stories using word processors, they did not disclose whether the students had been using pencil and paper or the computer to assist with prewriting.

The Effect on Planning and Organization

Several studies which looked at students' prewriting strategies found that planning occurred less frequently in writing done with a word processor than with pen and paper (Beserra, 1986; Dalton and Watson, 1986; Haas, 1987a, 1989; Lutz, 1987).

Haas (1987a), in her study of professional writers, found that both initial planning (before the writer begins composing) and evaluative planning (re-reading after having written) are reduced when composing with a word processor. As well, Neuwirth, Haas, & Hayes (1990), in their study of post-secondary students and professional writers, found that writers using word processing alone engaged in significantly less initial planning, conceptual planning and total planning than when they used pen and paper. Such "erosion" of preplanning, organization, and focus has also been noted by Liechty (1989) who, from her review of the research, concluded that such a tendency necessitates instructional intervention.

Aschauer and White (1984), commenting on constructing an outline as part of writing with a word processor, cautioned that any heuristic program that is developed or used in the writing classroom must not simply ask students to outline or to list, for that would counteract the recursiveness of process writing.

Peacock and Breese (1990) found that using a word processor affected <u>when</u> students worked on planning. In their study of two groups of students ages 10-11 using portable word processors, they found that students using the machines engaged in less initial planning: some of them felt that planning was something to be done while writing a second draft.

While many researchers noted a deterioration in overall planning when writers were using a word processor, the machines did benefit writers in other ways. For instance, Boiarsky (1991) found that the fluidity and fluency of students' writing increased.

The Effect on Composing

The effect of a word processor on the act of composition appears to be at least twofold: there tends to be less in-process planning and more in-process revision.

Researchers have noted that writers frequently engage in planning as they are writing. In their case studies of experienced writers, Bridwell, Johnson and Brehe (1986) noticed their subjects were pausing and jotting down notes as they began engaging in the initial stages of the act of writing. Document analysis revealed that the writers' notes were often metacomments, suggesting considerations for future stages in the writing process.

Neuwirth et al. (1990) observed similar writing behavior: examining the notes which writers made both before and during their writing of the main text, they assessed such notes to be mostly concerning planning. Neuwirth noted that, with word processing, writers tended to make content notes only, while with pen and paper they made a variety of planning notes including content notes, structure notes, emphasis notes, and procedural notes.

Some researchers (Beserra, 1986; Liechty, 1989) also found that the act of composing text with a word processor is frequently teeming with revision. Beserra found that students using a word processor "revise differently" compared with students writing with pen and paper: not only did the students revise their work at the completion of a particular writing task, they made revisions during composing (p. 252).

However, Liechty offered a caution: from the research she reviewed, she speculated that such in-process revision might interrupt the composing process. This concern seemed to be examined by Joram, Woodruff, Bryson, and Linsay (1992). In their study of eighth graders, they found that requesting writers to compose but not to revise during the writing of an initial draft improved the performance of the above average writers using word processors but did not have as positive an effect for these same writers using pencil and paper. Average writers produced their best papers when they wrote with word processors and were permitted to revise freely.

The Effect on Revision and Editing

It is difficult to assess the influence of word processors on revision strategies because of the complexity of the act of revision (Liechty, 1989). Not only the complexity of the act of revision but the varying interpretations of its very nature as it differs from editing and proofreading has created certain problems for researchers examining the impact of word processing on these aspects of writing. Liechty stated that results indicating the influence of the technology on revision strategies had been the most difficult to interpret because of this complexity and because of such varying interpretations, and that this

problem with terminology inhibits one's ability to make confident comparisons of one study with another.

What are Revision and Editing?

Leonardi and McDonald (1987) defined revision as a process of rethinking and reformulation. Harris (1985) defined editing and proofreading as processes which affect only the surface features of a text (for example, spelling punctuation, and grammar). Reynolds and Hart (1990) contended that, in the recursive model of writing, revision is a central notion: it is the process in which writing is grounded. It is an essential aspect of rethinking and discovering the meaning that the writer intends to communicate (p. 273). Extensive revision has been shown to be one of the most important components of the writing process and the one that perhaps most clearly distinguishes novice from expert writers (Daiute, 1986a; Etchison, 1985; Hawisher, 1987).

Does Word Processing Facilitate Revision and Editing?

The nature of writing invites revision and editing, for unlike talk one is able to look back on it and re-vision it. D'Arcy (1989) suggested that we can retain, re-collect, re-construct, re-create, and re-represent writing. Edwards (1992a) suggests that this process of re-examining, re-defining, and reorganizing ideas and thoughts appears to be basic to the learning process.

One would expect that word processing by its very nature, the ease with which a writer can manipulate text, would invite revision and editing. Some of the earliest pronouncements by such researchers as Moran (1983) and Daiute (1983) contended that the ease and flexibility afforded by the technology removes from the revising process the "copying penalty" and could relieve the "tedious process" of recopying, thus sparing writers the negative experience of writer's cramp. Dalton and Hannafin (1987) concurred: they found that, for their seventh-grade participants, word processing appeared to make writing and revision less tedious. Spence (1986) suggested that the ability to revise easily, especially when using a word processor, results in a writer viewing his or her piece as a "current version" rather than a finished product.

Some studies reported that wordprocessed text seems to demonstrate revision strategies which are substantive. De Almeida-Van Hooydonk (1986), in her study of seventh graders, observed that the majority of textual changes attempted by students were in the areas of mechanics and style, with the most significant changes occurring in matters of style. Fernandez (1987), in his study of sixth graders, offered similar observations: revision increased, and such changes went beyond the usual surface corrections and included movement of text, diction change, substantive content change both in terms of deletion and substitution of ideas, and an overall reformulation of text.

However, some studies have found that placing a word processor in front of a writer does not automatically result in a product which has been revised. McAllister and Louth (1988), in their study of college freshmen compositions, found that while students using a word processor may be more aware of the area of revision, there is no guarantee that they will utilize the technology to assist in the making of revisions. Liechty (1989), in her survey of the research, concluded that "writers do not automatically significantly revise their work simply because it is easier to do so" (p. 54). Harris (1985), too, sounded a note of pessimism by offering this caution: "We cannot assume that students will revise more or be more effective revisers when they use a word processor than when they do not" (p. 330).

Some researchers found minimal effects for revision. Carter (1990), in his study of sixth graders and Kane (1983), in her study of eighth graders, found most changes were corrections to spelling and punctuation. Several researchers such as Beale & Griffin (1987), Lytle (1988), and Schanck (1986), in their study of students from grades three through seven, noted few changes involved making revisions to meaning or content. Grizinski (1986), in her study of high school students' writing, and Posey (1986), in her study of basic writers, determined that, while writers using word processing made more changes to their text than those using pen and paper, few if any changes were made which were substantive. Harris (1985), in her study of six freshman honors students, determined that use of a word processor resulted in fewer significant revisions for these writers.

Further, a number of studies found that writers made better, more significant revisions with pen and paper than they did with a word processor (Collier, 1983; Daiute, 1986; Freedman and Clarke, 1988; and Hawisher, 1987). The study by Freedman and Clarke also tested revision done with text displayed on the word processor and rendered as hardcopy. Interestingly, when students printed a hardcopy of their text, revision quality approached the results found when students used pen and paper only.

Concerning whether the use of a word processor helps a student edit his or her work, the findings seem more consistent. Outhred (1987), in her study of learning disabled students aged eight to twelve years, found that children with severe spelling problems made fewer errors in their wordprocessed stories. Owston, Murphy, and Wideman (1991), in their study of eighth graders experienced in word processing, also found that spelling was significantly better when students utilized word processors. As well, Laidley (1990), in her study of sixth grade students, found that those students who edited wordprocessed text made fewer incorrect corrections and twice as many conceptual error corrections than those who worked with text written with pencil and paper.

Peterson and Lou (1991) found that teachers who were rating high school students' papers in their study commented that such things as problems with paragraphing, misspelled words, and errors in capitalization and punctuation were easier to spot: the errors "jumped out at them" in the wordprocessed form (p. 11). Franklin (1991) and Mathieu (1989) also concluded that the computer, because it rendered text more clearly than did handwriting, made it easier for students to find mistakes in their writing.

However, Rhodes and Ives (1991), in their study of college-level writers, found that students writing with pens or with typewriters made more changes from the first to the last draft than did those writers using word processors. As well, Yau, Ziegler and Siegel (1990), in their study of seventh- and eight-grade learning disabled students, found that the writing of frequent users of portable word processors compared with students using pen and paper showed no difference in surface features such as spelling and punctuation.

Owston et al. (1991) found that, while experienced writers revise extensively at the sentence and paragraph level and that their revisions focus primarily on the substance, form, and shape of their argument, contrastingly, eighth-grade students employ changes to their texts chiefly to correct perceived errors in syntax or failures to conform to rules of form. De Almeida-Van Hooydonk (1986), in her study of seventh graders, noted a reluctance of students to critique and self-evaluate the first draft. Other researchers (Bereiter & Scardamalia, 1987; Sommers, 1980) have noted that, with writers at this age, revision at a deeper level involving textual reordering or addition is rarely carried out.

While it might seem from the conclusions offered by these last few studies that a student's tendency to engage in effective strategies involving revision may be a product of his or her age, there seems to be no guarantee that an older writer is one who revises: Grow (1988), in his study of professional writers using word processors, noted that the writer-participants tended to edit instead of revise and rethink their writing.

It may be that the inherent strength of the word processor to facilitate the making of changes to text may also be its greatest weakness: some teachers and students might focus primarily on the machine's ability to help create writing which is "correct" and ignore its ability to help make those revisions which can contribute to a text's effectiveness. In Mathieu's study of seventh-grade students (1989), a statement made by one of her teacher-participants seems to suggest this tendency to concentrate on editing:

> One of the major strengths of doing your work on a computer using a word processing program is its ability to edit: Because that's what it's there for. When your language arts teacher returns your writing assignment and tells you to correct your errors, it's very easy to do if it's on computer. (p. 4)

The Role of Hardcopy in Student Writing

Some researchers have found that screen-generated text has a positive effect on writing behaviors. Phenix and Hannan (1984), in their study of first graders, noted that a particular writing behavior, rereading of text, was observed more often in young writers using word processors than those using pencil and paper. Butler-Nalin (1987), in her study of eighth-grade students' writing, contended that wordprocessed text displayed on a computer screen may stimulate additional monitoring of the writing.

However, many word processor users have experienced difficulty with reading the text on their computer monitors. In order to maintain control over the evolution of their ideas, writers need to skim their text; however, the small amount of text displayed on a computer monitor at one time "blinkers" what one can see. Harris (1985) found that such limited "seeing" seems to deter students from making large scale organizational changes.

Neuwirth et al. (1990), conducting a study of six college freshmen and five adult writers, examined what they called the "text sense problem," the difficulty which users of word processors were experiencing in acquiring a sense of the "big picture" of their writing and in recalling what they had written:

> In our interviews with numerous computer writers and in our study of computer writers' reading problems we frequently encountered what writers themselves called "a problem getting a sense of the text." When using word processing, these writers spoke of often feeling confusion about the shape and form of their own emerging texts . . . . This problem seemed to go beyond a necessity to read-to-revise: many of the writers simply felt they didn't "know" their texts as well when they composed them on-line. (p. 10)

To analyse overall composition structure, many student writers have shown that they prefer to use hardcopy printouts of their text (Balajthy, McKeveny and Lacitiguola, 1986; Neuwirth et al., 1990).

Neuwirth found that writers used printouts for four reading purposes: to check format, to proofread, to reorganize, and to gain "a sense of the text." Student writers tended to be more concerned with format and proofreading, while experienced writers tended to read for all four purposes. As well, longer and more complex tasks elicited more reading to organize and reading to gain a sense of the text.

Other researchers touted the importance of hardcopy in process writing with a word processor. Fitschen (1986) found that revising one's writing on hardcopy after using the word processor for composing reduces both computer and writing anxiety, provides greater opportunity for decentering, and is more comfortable than revising on the screen. Haas (1987c), in her study of older, more able writers, found that writers did more rereading of text rendered as hardcopy. Lutz (1987) contended that if writers work with

only screen-rendered text, they may have a tendency to focus only on lower-level changes to their writing. Consequently they may need to be encouraged to use a hardcopy of their work or else rely on pen and paper to assist with organizing larger chunks of text, such as paragraphs.

While Neuwirth found that writers may need to print out a hardcopy of their work at various stages of their writing processes, other researchers found that writers frequently obtained a printout when they wanted to revise or edit their work. Muldrow (1986) found that her ninth grade students used a hard copy to help them highlight problem areas in their writing, that it made her students more conscious of spelling errors. She also contended that they were more critical of their work when they saw it in hard copy, and routinely returned to the word processor, printout in hand, to revise or edit further. Printing a hardcopy became an integral part of, rather than the end of, their composition processes. Peacock and Breese (1990) found that the students ages 10-11 whom they observed all expressed a preference for revising drafts from a printout rather than reading the text on the screen. Rude and Smith (1992) as well, in their study of 94 professional editors, found that two-thirds of them depended on a printed hardcopy to assist them with the task of editing.

The Importance of Printer Availability

Inseparable from a discussion of the role of hardcopy in writing is the importance of printer availability. Printers conveniently provide neat, typed copies of the work in progress for the individual student or for all members of a group to read and critique (MacArthur, 1988). In their three-year study of grade eight students, Eastman, Hollingsworth, Hong, Bhatia, and Agnostino (1989) found that student use of printers was a key to increased feedback from others and led to increased revising and editing of their work. Neuwirth et al. (1990) suggested frequent print-outs of drafts, adding that a "paperless" writing curriculum should not be encouraged.

Although most studies do not include much detail about the number of printers which were available for students to use to print hard copies of their work-in-process, Holian and Chismar (1991) mentioned that the writing center described in their study included 15 computers and 5 printers--a printer-to-computer ratio of 1-to-3.

Word Processing and Collaboration

One of the important aspects of the writing which is occurring in many classrooms is the phenomena of the "writing community" and "audience community" (Atwell, 1987; Calkins, 1983; Graves, 1983; Murray, 1985, 1989). Montague (1990) contended that the

most salient feature of writing process instruction may be the collaboration which occurs among students and teachers who collectively are a community of writers. In this community, students are actively involved in more than the writing down of sentences: they are given the opportunity to think about their writing, discuss their writing with peers or their teacher, revise their plans or drafts, and read their works to other students. Collaborative writing can be an alternative to independent writing within a computer environment.

Collaboration: Its Nature and Worth

The observations of both Atwell (1987) and Goodlad (1984) suggest that the culture of junior high is highly social. If we recognize the culture which exists in the middle grades, we are apt to notice that talk is a considerable part of that culture. A productive way in which to capitalize on this behavior may be to create collaborative groupings. As Brown, Collins, and Duguid (1989) maintained, groups are not just a convenient way to accumulate the individual knowledge of their members. They give rise synergistically to insights and solutions that would not come about without them. Groups can be efficient in drawing out, confronting and discussing both misconceptions and ineffective strategies. Brown et al. contended that

> within a culture, ideas are exchanged and modified and belief systems developed and appropriated through conversation and narratives, so these must be practiced, not inhibited. Though they are often anathema to traditional schooling, they are an essential component of social interaction and, thus, of learning. (p. 40)

Brown further maintained that approaches which embed learning in activity and make deliberate use of the social and physical context are more in line with the understanding of learning and cognition that is emerging from research.

Other researchers were also supportive of the idea of peer collaboration. Tone and Winchester (1988), as if concurring with Brown, contended that social interaction on writing tasks aids in the development of language skills. Kerr (1990) maintained that it is imperative that the teacher remove herself from the setting and that students develop their own support network from their peer group.

The research suggested that there are several advantages to having students work collaboratively when working with computers. The Laboratory of Comparative Human Cognition (1989) contended that collaboration at a machine reduces low-level errors and creates support for higher level activities. Johnson and Johnson (1985) contended that group computer use allows summarizing and explaining, and promotes social modeling and peer reinforcing. Barker (1987), in his review of the literature, noted that the technology brings lower and higher learning ability groups together in peer-teaching groups.

The Laboratory of Comparative Human Cognition also reported that children who work together are routinely observed to correct one another's mistakes, cooperate in the completion of assigned tasks, and discuss the assignments in ways that clarify the task, even when neither partner appears to understand it at the outset.

A further characteristic was noted by Harris (1992) in her study of the attitudes and behaviors of third graders writing with word processors. She found that in the community of learners fostered by the use of word processors, "experts" emerge and are so recognized by their peers.

A learning environment that encourages active participation of learners and interchange among learners and teachers is crucial to academic development (Montague, 1990). Krendl and Lieberman (1988) also contend that, compared to solitary computer work, working in a small group at the computer can enhance and, in some cases, improve academic achievement.

Some researchers contended that collaborative groupings were more effective than students working on their own. Watson (1990) maintained that the research indicates that groups of students on computers, even those who have no training in cooperative learning, do as well or better than individuals. Johnson, Johnson & Stanne (1985) found that cooperative groups were faster and more accurate than individualistic and competitive groups, and conversation was more on-task.

Looking more specifically at collaboration and writing, both Sudol (1985) and Mathieu (1989) noted that when writers perform such activities as brainstorming, revising, and collaborating in the computer lab, they form a community of writers whose work becomes public. Sudol contended that such an experience has a liberating effect: rather than writing primarily for the teacher, the students write for various purposes and audiences, and in so doing exercise their own keen judgement. Further, Norris (1990), in her study of fifth- and sixth-graders, found that the utilization of word processing and an active audience seemed to have a positive impact on students' writing processes. Daiute (1985) contended that such sharing helps writers learn about voice and their reader's needs. As well, Daiute contended that students who engage in collaboration using word processors enjoy what they are doing because they feel they can work more freely.

Dale (1993) in her study of triads of eighth grade English students who engaged in co-authoring a persuasive essay found such a task beneficial. Her findings suggested that when students engage with each other productively in co-authoring groups, the text becomes the mediator of multiple perspectives and a record of socially-constructed meaning. As well, the students can learn much about writing from one another: for example, the students in her study learned various ways to plan from one another. Dale

also observed that revision was built into the co-authoring process recursively as students suggested alternative ideas and phrasing. Dale also maintained that, if students feel comfortable with one another, they can disagree and challenge one another, thereby encouraging each other to elaborate and to defend and explain their choices. As Calkins (1991) maintained: "We need people to hear our stories and recall their own. We need people to laugh, to cry, to agree or disagree, to question or argue" (p. 107).

Does the Presence of Computers Encourage Collaboration?

Overwhelmingly, studies examining the effect of a word processor on writing have noted that the technology seems to foster collaborative behaviors and that such behaviors are positive. Barker (1987), in his review of the literature concerning collaboration and writing, generally found that word processors encourage collaboration among writers, particularly in the areas of assisting in the sharing of writing problems and concerns and developing strategies to deal with them. Liechty (1989), in her survey of the research, contended that studies representing all age and ability groups of writers reported a significant increase in student collaboration with the use of word processors.

The presence of microcomputers in a classroom seems to foster more social interaction among peers and increased talk (Fisher,1984; Greene, 1985; Jackson, 1987; Mathieu, 1989). Stapp (1987) and Mathieu (1989), looking at students in grades five and seven respectively, noted more peer teaching behavior in which students were working together to solve problems at the computer.

Students also seem to find that discussing problems which they are experiencing as writers is easier in a collaborative setting. Daiute (1985), Greene (1985), and Mathieu (1989) noticed that, in such an environment, students shared their writing, both the problems and the successes, spontaneously.

When working collaboratively with one another while using a word processor, students seem to stay on task. Rodrigues (1984) observed that, on the whole, students who used computers tended to engage more in talk concerning their writing than those who did not use the technology. Carrier and Sales (1987), when they studied patterns of verbal interaction within groups working together on computers, found that students were on task 77 per cent of the time. As well, students in pairs sought more elaborative explanations than individuals did. Daiute (1985) contended that writing classes with computers tended to be characterized by a great deal of writing being attempted.

Johnson et al. (1985) and Mathieu (1989) noted that students using the word processor to assist with writing needed less teacher help. Mathieu noted that, in the setting of a computer lab, the teacher had become the students' second source of help: he was

called upon only after the individual student or a neighbouring student could not get a particular program to work.

Some researchers have speculated that the appearance of wordprocessed text, its presentability, encourages collaborative activities. Mathieu (1989) mentioned that one of her teacher-participants had noted an increased student interaction in the computer lab as compared to when he taught the same students mathematics. She speculated that such collaboration among writers is not only influenced by the appearance of wordprocessed work; it also may be the product of students feeling that their writing is better. Eastman et al. (1989) also maintained that how student work appears to others becomes important in getting help in learning to write from classmates, parents and teachers.

Mehan (1989) contended that student collaboration on computer tasks is different from that on other school tasks, and goes so far as to claim that such collaborative behaviors apparently remain exclusive to the computer setting.

Mathieu (1989) also observed one further aspect of collaborative writing and word processing: for some students, having limits on when they could share their work and conference on it was a problem, for they found it difficult not to share whenever they felt like it.

Group Size, Configuration and Collaborative Writing

Wresch (1990) describes the decision one junior high teacher arrived at concerning the number of students to place in a collaborative grouping. She decided that three students could fit comfortably around a tabletop computer while ensuring an adequate flow of ideas to be combined into one piece of writing. In each group she tried to include at least one student with computer background.

Fisher (1984), Krendl and Lieberman (1988), and Okey and Majer (1976) found, in general, that groups of two or three are most effective, with two being the optimum size. Krendl and Lieberman also found that students working in pairs tutor each other more, while trios seemed to compete with one another.

The Public Nature of Display Screens and Hardcopy

While one might speculate that the readability of wordprocessed text is one explanation of the degree of sharing which takes place in a learning environment equipped with word processors, Morocco and Neuman (1986), in their study of fourth grade students, contended that collaboration is fostered most strongly by two other factors: the "public" nature of this type of composing and the ease with which the computer monitor permits others to view a piece of writing at any stage of the process.

Other researchers concur. Kahn & Paris (1986) and Black (1989) contended that such screen-generated text facilitates social interaction and peer conferencing. Mathieu (1989) found that the public nature of the computer screen resulted in students engaging in a great deal of task-related talk. Hawisher (1989b) maintained that using a word processor removes the isolation that a writing activity often imposes, a view shared by Johnson and Johnson (1985).

Looking at the public nature of hardcopy, Mathieu (1989) observed that some students waiting in line to run off their work from the printer may tend to read another student's printout as it is being produced. While Mathieu was concerned initially about the public nature of such a situation imposing on the traditionally private world of writing-in-process, the grade seven students in her study showed no such concern; instead, most of them appreciated the concern and advice they got from their peers about changes they could make in their next draft.

Collaboration and Authorship

When students are collaborating over a piece of writing, what happens to authorship? Garrett-Petts (1988) contended that writing as a process of social interaction, rather than an individual act, may come to challenge the idea of individual authorship.

An interesting observation concerning collaboration and authorship was offered by Crawford (1989): in his study of fourth grade writers, he found that often a student who had been working with a peer on a piece of writing would put off working on the piece alone.

Mathieu (1989) described a collaborative writing event in which several hands and minds are involved with text creation:

> After having finished their assignments, several students worked collaboratively at one computer writing a funny story. They conversed and laughed as they added to their developing story. . . . They alternated between computers each adding a sentence or two to the other story before they switched computers. (p. 64)

In such a collaborative instance, who is the author of the piece?

The Effect of the Word Processor on Student Attitudes

Students' attitudes are important indicators of the word processor's acceptance as a tool for composition. Feldman (1984), in his study of college-level students, states that the accounts of students themselves are well worth considering, for it is no secret that students' attitudes and perceptions play a large role in how willing they are to work at acquiring writing proficiency.

Blankenbaker and Hamstra (1989) maintained that the word processor supports the slow, erratic development of writing by allowing the writer to learn through trial and error, and that, with the combined support of the teacher as collaborator and the processor as a tool, student writers can believe in their ability to write.

Studies have repeatedly reported that word processors have a positive effect on writer attitudes. Liechty (1989), in her survey of the research, found that most writers of all ages and abilities preferred composing with a word processor rather than with pen and paper. Many studies (Barker, 1987; Carter, 1990; Daiute, 1985, 1986; Etchison, 1989; Haas, 1987a, 1989; Kurth, 1987; Laidley, 1990; MacArthur and Graham, 1987; Outhred, 1987; Owston,1991; Vacc, 1985) consistently found that students using word processors generally write more. As well, many studies (Beserra, 1986; Daiute, 1985; Haas, 1987a; Kane, 1983; Kurth and Stromberg, 1984; Lutz, 1987; Phenix and Hannan, 1984; Posey, 1986; Vacc, 1985; Woodruff, Bereiter, and Scardamalia, 1981) found that students worked on their writing for longer periods of time. Haas and Hayes (1986a) found that even experienced writers who were able to compose the same amount of text using either a word processor or pen and paper wrote for longer periods of time using a word processor.

It may be worth reflecting on a view articulated by Hawisher (1989b) and shared by Herrmann (1987b) that educators should be careful about how to interpret such findings as those noted above: a longer piece of writing is not necessarily better than a shorter one. As well, longer time spent on writing may indicate not so much a greater commitment with the work but an indication of weak keyboarding or program operating skills.

Besides finding that students authored longer texts and spent increased amounts of time on writing when using a word processor, some studies (Tiechman and Poris, 1985; Wheeler, 1985) reported reduced writing apprehension. Rodrigues (1984) contended that the word processor helps minimize the fear of failure: "The computer is infinitely patient, allowing the students to experiment with ideas, to play around with words without any fear of being criticized for not being exactly on target--in short, to take risks that move writers toward greater competence" (p. 28). Roth (1986), in his study of vocational college students, found that with computer-assisted instruction the students became more confident and eager to begin their research.

Further, numerous studies (Bierman, 1988; Greenleaf, 1990; Kahn, 1988; Owston, 1991) found that students' were more motivated: they paid more careful attention to correcting punctuation, spelling and grammar in their writing and made a greater effort to revise their work. Mathieu (1989) suggested that writing with a word processor may instill in some students a desire for perfection in their writing. Mathieu also noted students'

willingness to revise and correct an exam/assignment even after it had been evaluated by the computer or language arts teacher and handed back.

Frankling (1991), in her study of seventh grade language arts students using Tandy portable word processors, suggested that such positive attention to correctness could be the product of the machines allowing students to be more objective about their work. She quoted a classroom teacher as saying: "When students see their writing printed out, they're much more willing to correct it. For some reason, errors are not a personal affront to them" (p. 41).

Further, Black (1989), in her study of fifth-grade, low-income, single-parent families with very low languaging skills, found that the use of word processors seemed to affect student attitudes in that classwork and homework were handed-in promptly.

A number of studies (Baer,1986, 1988; Daiute, 1985; Morocco and Neuman, 1986) also found that a majority of students enjoyed writing more when they used the word processor. Daiute particularly found that children think writing on a computer is easier and more fun than using pencil and paper primarily because it eliminates recopying of text.

Also affected positively may be student attitude towards instruction. Kurth (1987), working with ninth-grade students using word processors, found that they felt more positive about the instruction they had received, more positive about their ability to write, and more positive about editing groups.

Baer (1988) also noted that students said that mistakes were easier to see and correct, and they found the final product neater. Students felt they could concentrate better while using the computers. They also felt they could produce better work as a result: the keyboard characters reminded some students to use punctuation marks, while others felt they were more in control of their work with the word processing program.

Muldrow (1986) found that word processing helped those on the fringes of her school's writing groups to actually write. These students were inhibited by the turtle-paced awkwardness of their work, its messiness and fears of classmates' negative reactions; however, using a word processor gave these students a willingness to develop text, to revise and edit, and to share their finished product. Mathieu (1989) contended that because the word processor produces professional-looking text, using it stimulates students to write something that can be unabashedly shared within or outside the classroom.

Mathieu also found that students using different writing tools may demonstrate contrasting attitudes. One student, having used her uncle's typewriter to do her final draft, was apprehensive about receiving feedback, and commented that she hoped there would not be so many mistakes that she would have to retype the composition. Another student, having used the word processor, demonstrated the opposite attitude to having her work

read: she hoped her reader would find every error because she intended to do another draft. For the latter student errors were something to be found and corrected, whereas for the former student they caused anxiety.

Word Processing and Teaching

Some research has also examined the way in which teachers have integrated word processors into their existing teaching style or altered their styles either to accommodate or capitalize on the technology's use. Moving writing classes from the English language arts classroom to the computer lab or having a classroom of students using portable word processors may create new classroom dynamics resulting in positive changes and challenges in both teaching and learning (Holian and Chismar, 1991).

However, in some studies there has been a disappointing lack of focus on the impact of instructional strategies on the effects achieved with the use of word processors (MacArthur and Graham, 1987). This lack of focus has made it difficult to identify whether the subjects in some of these studies actually received writing instruction as a part of the experimental treatment (Liechty, 1989), and consequently it has been difficult to determine the impact of such instructional strategies.

The Importance of Instruction

The word processor is not a panacea for the difficult task of teachers teaching and student's learning about writing. Peacock and Breese (1990) commented that, in their view, the conviction has been widespread among teachers that writing with a word processor leads to an improvement in the quality of student written work, and that such an assumption has been based on the belief that the ability of the technology to manipulate text would result in better writing.

Balajthy et al. (1986-87) remarked that when word processors were first introduced into classrooms, many teachers believed children would just naturally carry out experimentation with the language: "After all, they reasoned, it is easy to change a sentence or a paragraph" (28). However, educators found that the statistical difference in the amount of writing and revision done by children using word processors than by those using pencils is so small that it is of little educational significance. Balajthy contended that word processing must supplement writing instruction not replace it, saying that teachers still need to teach students the writing process, guide their construction of compositions, and provide feedback.

Partridge (1987) concurred, saying that while word processing can enhance the teaching of written composition, it should never be used as a substitute for teaching the basic elements of good writing. Students using word processors will often limit their changes to superficial, mechanical alterations, unless taught by teachers to do more sophisticated revisions. Haas (1987) stressed that if computers are to be used effectively in the writing classroom, students must learn not only word processing but awareness and adaptation of their writing processes.

In sum, students need to be taught. As mentioned previously, Liechty (1989) contended that a student writer's tendency to do less planning when working with wordprocessed text necessitates instructional intervention. Faigley, Cherry, Joliffe, and Skinner (1985) noted that young writers have virtually no strategies for composing extended texts. As writers mature, they develop strategies which are useful in various writing situations. Daiute (1985) maintained that this progression from beginning writer to mature writer is not a natural occurrence for many learners who may require explicit instruction in planning, composing, reviewing and monitoring their writing.

Collaboration and Instruction

Johnson et al. (1985) found that students trained in cooperative learning do even better in group work than do students not trained. This suggests that, if teachers believe that collaborative learning is an essential part of working with word processing, especially with machines whose portability encourages students' moving to a writing partner and seeking assistance, formal instruction on how to work effectively in such groupings is necessary.

Revision, Editing, and the Importance of Instruction

Webb (1992), studying undergraduates' reading behavior during composition at the word processor, noted that those who apparently reread their texts more did not necessarily rewrite more. Webb interpreted this to mean that instruction may benefit by including observations and discussion of reading during composition in the classroom.

Balajthy et al. (1986), in their review of the literature, found that students using a word processor tended to limit their revisions to superficial, mechanical alterations unless they had been taught to make more sophisticated revisions. They suggested that providing students with access to word processors does not automatically mean that they will engage in revision. Here the role of the classroom teacher may become extremely important, for he or she is the one who guides the student through a writing process and shows the student how to revise his or her work, a process which requires that the act of revision be continually monitored and instruction repeated.

Curtis (1988) concurred, making the point that teachers wrongly assumed that the functions of word processing which they found useful in revision (for example, moving and substituting text) would in themselves change inexperienced writers. She maintained that while the keyboarding functions involved in making changes may be convenient, the actual act is not easy. Students may need more instruction on how to revise using the word processor and how it differs from revision when composing with paper and pencil (Carter, 1990).

The findings of De Almeida-Van Hooydonk (1986), Harris (1985), and Leonardi and McDonald (1987) also support the idea that students may need to be taught how to revise with a word processor. In their work with high school students, Leonardi and McDonald recommended that students should be introduced to revision using a word processor only after they understand the nature of revision: that it requires rethinking and reformulation. They contended that, if this step is omitted, the changes which students will make to their text will primarily involve correcting such things as spelling and punctuation. De Almeida-Van Hooydonk (1986), in her study of grade seven students, found precisely that: she noted that the students generally seemed to associate revision with proofreading: revision meant going over and checking for mistakes.

Perhaps what contributes to some students' inability to differentiate between revision and editing is the tendency of some teachers to see them as being one and the same. This certainly seems to have been the case even with some researchers (for example, Joram et al., 1990). Flinn (1986), studying sixth graders, found that students tended to revise based on the strategies most stressed by the teacher and that what most shaped the final product was the instructional emphasis.

I contend that what some call "language skills" should be more appropriately called "editing skills" or the writer's ability to embrace the mechanical conventions of the language--important skills, but only part of a much larger picture of a person's languaging abilities.

Instruction and Attitude

Leonardi and McDonald (1987) maintained that students do not become writing enthusiasts simply by using a word processor for composition; rather the role of the teacher is important. They envisioned teachers using computers as a means to develop the interactions necessary to establishing a sense of writing competence, and, in turn, writing enthusiasm.

Baer (1988) contended that teachers seeking improvement of students' attitudes toward their writing assignments should consider content, place (where the writing occurs), and method (pen and paper or word processor) when planning writing programs.

Baer further contended that using word processing to augment a process-oriented writing program can encourage students to view writing as a dynamic activity, can help students avoid recopying, and can relieve some of the students' error-consciousness while they compose.

Rethinking Teaching

Schlender (1991) maintained that, for some educators, the presence of portable word processors will require a rethinking of teaching methods. A teacher will no longer be able to keep all students in the same place doing the same activity. Schlender also contended that such machines will also force teachers to become managers of learning rather than imparters of knowledge. In other words, they must "retool."

Recent research seems to support Schlender's contentions. Holian and Chismar (1991), in their study of college-age writers, concurred, stating that the atmosphere of the computer lab encourages collaboration and allows the instructor to become a facilitator rather than a lecturer. Snyder (1990), in her comparison of two year eight classes, found that the computer classroom was more student-centred, less teacher dominated and more work-focused.

Dalton (1989) recommended a number of strategies in which students using word processors could engage to improve their writing skills and attitudes towards writing. Included are such pre-writing strategies as group brainstorming, story webs, free-writing and journal entries which can be carried out with either the word processor or pen and paper. To stimulate student interest and facilitate composition, Dalton suggested collaboration. To improve revision and editing skills, Dalton suggested focusing on one aspect of writing per pass through the text and printing out subsequent drafts.

Muldrow (1986) recounted that she underwent a personal reorientating as a teacher with the introduction of word processing into her grade nine English classroom in that she was no longer the "information guru" but a member of the writing group which shared their strengths, and developed greater skills as writers and as processors. She also found that she was modelling her own writing, and that her students saw her as a struggling writer just like themselves.

A number of researchers (Balajthy et al., 1986-87; Daiute, 1985; Montague, 1990; and Wresch,1990) described a particular teaching method which illustrates how the classroom teacher might model for his or her students some of the strategies involved in using the word processor for collaborative writing projects. Using a word processor and large monitors or a projection system as a "dynamic blackboard," the teacher sits at the computer, ready to input anything the students suggest. The students can see the random listing of this brainstorming as it materializes. The teacher can move on to other aspects of

writing, such as the creation of a thesis statement, the composing of paragraph, or the construction of a tentative introduction. Wresch contended that, regardless of what the class has contributed by the end of the hour, they will have a clearer grasp of how a literary paper can be crafted. Montague added that this kind of activity can help prepare students for composing within a more fully equipped computer environment.

Reflecting on their observations of the influence of word processing on the revisions of firth graders, Grejda and Hannafin (1992) offered this meaningful conclusion about the impact of the technology on teaching methods:

> It seems certain that traditional instruction methods cannot be mapped directly into writing via word processing: the technology offers both potentials and perils that are unique. While it is clear that word processing has significant potential to improve young writers' compositions, it is equally clear that methods that optimize both the technological and human aspects of writing have yet to be developed. (p. 100)

Collegial Dialoguing

While the challenges involved with utilizing word processing in one's writing curriculum will undoubtedly be considerable, teachers may stand to gain as much as their students. Aside from experiencing the satisfaction of helping students articulate their understandings and improve both their proficiency in and confidence towards writing, teachers may also gain from the teacher collaboration which employing the technology can foster. Schlender (1991), remarking about the experiences of teachers who had taught classes of students who brought portable word processors into the classroom, contended that the greatest benefit of this program for teachers had been the professional discussion and planning that had to take place: "The four core teachers have held discussions on teaching strategies, integration and methodology, which have been both exciting and refreshing" (32).

Word Processing and Interdisciplinary Teaching and Learning

Not many years ago, many teachers viewed the tabletop computer as being a tool most useful to the teaching of maths; however, since then word processing programs have meant that the computer has been increasingly thought of as a tool which might assist student writing. Mathieu (1989) contended that the computer, in some capacities, may have more potential for language arts teachers than it does for teachers of mathematics.

At the same time, as 'language across the curriculum' becomes more reality than rhetoric, the computer as word processor is undergoing an evolution: instead of being a tool which might assist learning mostly in language arts classes, its potential is being recognized as a means to assist learning in other subject areas.

The portable laptop word processor, a writing tool which can accompany the student into a variety of subject classrooms, may be an appropriate tool for thinking. In using such a technology effectively, it may be necessary to understand the particular kinds of thinking skills and processes which arise in the specific curriculum areas. As Kelman (1990) suggested: "Ask not what a computer can do for science, social studies, and other curricula; ask what computer tools are needed to address such tasks, problems, or concepts in those subjects."

Some things such as limited machine availability might seem to stand in the way of integrating the technology, but these might not be all that difficult compared with one particular concern: Mehan (1989) contended that an important factor affecting such integration may be the extent of teachers' computer expertise.

Teacher Understanding and the Successful Use of Word Processing

Orientation to the Technology

Several researchers (Herrmann, 1987a;, Levin, 1990; Paszek,1991) observed numerous obstacles which appeared to stand in the way of effective implementation and integration of computers into the learning environments of a school.

One important element is training: how well teachers and students are orientated to word processing in general and a specific machine and program in particular may affect how well the technology is used. Levin noted at the elementary school site she observed that teachers were inadequately trained and lacked time for observation and reflection, and they were reluctant to use the technology. Herrmann, in her study, suggested that teachers require opportunities and incentives to acquire the skills it takes to understand and teach with computers. Paszek arrived at a similar conclusion, stating that the actual implementation of computers into a writing classroom requires considerable preparation and planning.

A second important factor affecting implementation and integration concerns empowerment: those students and teachers most directly affected by the technology should be consulted and the feedback considered seriously. Wise (1979) cautioned that, unless decision-makers possess reliable knowledge, the consequences of externally mandated change can be negative. Herrmann contended that teachers should be the ones who decide the role of the computer in their classroom (i.e. to provide drill and practice or function as a composing tool). Paszek seemed to concur, saying that ownership of the change must belong to the teachers: as professionals, they should be able to make their own decisions about instituting change in their practice to improve learning.

Students need to be involved as well. Herrmann, in her study, concluded that teachers need to collaborate with students about their needs in computer-based writing classes. Paszek, having observed grade eleven students, arrived at a similar conclusion: students should be consulted, and they should be enabled by teachers to use, control, and make decisions about how they utilize the word processor.

A third important factor is administrative support. Levin noted that at the site she observed there was a lack of administrative support which was sustained. Herrmann suggested that administrators need to create ongoing inservice programs designed to be responsive to computer-using English teachers.

Both Levin and Herrmann concluded that administrators and teachers must develop a better understanding of how computers can best be used in their educational environment. Otherwise what may prevail is the type of situation similar to what Levin found at the school she observed: ill-prepared, uninvolved, and poorly supported by those making the decisions, the staff had neither a clear vision of computer use nor a plan for change, and consequently there was no attempt to define or bring about necessary social and organizational changes.

Understanding about Writing

Another factor which may affect the successful use of word processors in classrooms is what the teacher knows about writing. Knowledge about what writing is has been changing. Neuwirth et al. (1990), drawing upon the theoretical work of cognitive process researchers in writing, such as Flower and Hayes (1981) and Bereiter and Scardamalia (1987), view writing as a complex mental act, difficult to accomplish, to learn, and to analyze. Writing as defined through the lens of cognitive process theory is a decision-making process in which writers make important choices guided by their own knowledge and purposes, as well as being guided by other critical factors; it is a way to form new conceptual knowledge.

The word processor may be making significant contributions toward this shift in paradigms. Elizabeth Muldrow, a teacher for over twenty years when she published her study of grade nine students (1986), observed that many students begin the year believing that writing is an exercise which proceeds in deliberate steps from title to conclusion in a linear manner. With the word processor allowing manipulation of these steps, they begin to work in random order from one segment to another within the process itself. Muldrow contended that by each term's end several writers invariably demonstrate circular or other personal adaptations of the linear model for composition, that they have discovered writing as a recursive action.

Orientating teachers requires time and money. Lamb (1990) suggested that for every dollar apent on hardware there should be an equal number of dollars designated for teacher training, a rule of thumb which, according to Lamb, certain school boards in Ontario have learned. Such monies could be cost effective: Abtan (1991), assessing the use of computers in Canadian schools, maintained that at present the technology is used haphazardly, and that "it is easier to create a mess than not, leading to a waste of money" (p. 22).

Word Processing and the Type of Writing Task

Daiute (1985) suggested that teachers needed to discover which writing activities are better done with word processors than with pens or typewriters, and vice versa. As Selfe (1985) maintained, teachers cannot expect every student to embrace the computer as a favorite composing tool.

Snyder (1990) found that composing behaviors varied according to the genre of the task (narration, argument, report) rather than according to the influence of the writing tool. The Year Eight students she observed had a strong preference for composing narrative with pen and argument with word processor. She concluded that there was strong evidence of the efficacy of word processing in the promotion of quality in argument and report and weaker evidence for narrative.

Casella (1989) speculated that the word processor is perfect for composing poetry because of the formatting features and the ease of revision. Her assessment that "since poetry is written to be shared, it inspires students to write and publish" suggested that wordprocessed text would help facilitate such sharing (p. 28).

Peacock and Breese (1990) concluded that handwriting remains popular for children, especially for those tasks which are shorter than a few hundred words. They speculated that for those who become more fluent at keyboarding this balance might well alter in favour of the word processor.

Mathieu (1989), too, discovered that students were quite definite concerning the types of writing they preferred doing with word processors. She recounted a couple of incidents which arose during her inquiry where students rejected doing dummy-run assignments, including a keyboarding exercise to teach them more word-processing features and to review those already taught. The task, to reproduce some text from a Boy Scout Manual , was deemed by the students to be "a silly computer exercise;" instead, these same students tended to prefer working with writing tasks which were of their own invention.

In deciding which types of writing might be better suited to using a word processor, we might keep the observations of Balajthy et al. (1986) and Doyle (1988) in mind. Balajthy contended that word processors can encourage students to experiment with language, and that such experimentation is the result of viewing wordprocessed text as fluid rather than static. Doyle advocated having students use a word processor to engage in freewriting. Borrowing from Elbow (1973) the idea that freewriting, in that it requires a spontaneous, nonjudgmental, continuous flow of thoughts onto paper, helps some writers discover ideas, Doyle suggested having students engage in such writing with the computer display monitors turned off and with having been instructed not to edit. She maintained that, since turning off the monitor makes it impossible to look back to edit, change or cross out what has been written, the anxiety associated with writing with fear of mechanics or form was diminished.

A shift in roles in the teaching-learning situation can be brought about by encouraging reflective/dialogue journal writing. Regardless of the writing tools used, such writing shifts the focus in a classroom from the teacher-instructor to the student-learner. In a dialogue journal the voice of the writer is that of the teacher-learner attempting to articulate to another what it is he does and does not understand, and to learn from a reader's feedback and questions. The reader takes on the same set of roles, responding initially as a student-learner, and then moving into the role of the teacher-helper. By attempting such writing, and by reading and responding to such writing, each child becomes both a teacher and a learner, and the class teaches and learns together.

The findings of other researchers, such as D'Arcy (1987), Edwards and Walker (1990), Fulwiler (1987), Roderick and Berman (1984), and Staton, Shuy, Kreeft, and Reed (1982), seem to support that this type of writing may indeed suit the collaborative nature of a class engaging in word processing. Such writing is a vehicle which provides a space for rehearsal, reflection, reshaping, and re-drafting (D'Arcy, 1987). Typically, such journals are exchanged periodically (for example, weekly), with the readers responding in writing to what the writers have written. In this manner the two writing partners engage in a "dialogue." Together with the public nature of screen-generated text and the ease with which students can respond to a hardcopy, dialogue journals might be a very suitable and effective form of writing using this technology.

Further Issues Concerning Writing with a Word Processor

The Impact of Accessibility and Portability

Paszek (1991) maintained that an important issue concerning the use of computers in schools is their accessibility and availability. One of the senior high English teachers in his study described what may be a common situation in a number of schools: his students were having to compete with business education and computer processing students for lab time.

Some researchers have examined the impact of machine availability on student proficiency with a computer. Ward (1991) maintained that the missing link in making schools more effective than they are today remains access to the equipment. Dalton and Watson (1986), in their study of high ability seventh-grade students, attributed one of the reasons for a lack of efficacy of word processing to problems in accessing the computers. Dalton (1989) recommended that students be able to write on a word processor at least three times a weak.

Such continuous access to the technology may make its use seem second nature. Speaking of writing with a word processor, Papert (1988) stated: "We've only succeeded when it becomes invisible" (p. 17).

Mathieu (1989) identified a number of concerns stemming from limited machine availability. She contended that the biggest drawback to writing in a computer lab is access to the lab. In many if not most instances, a school's tabletop computers are in the computer lab, and unless the language arts class is able to reserve time in that lab, the students are not able to access computers during language arts class. Mathieu stated that "if students are going to use computers in the classroom for writing in a process-oriented way, they need to have a lot of access to the computers" (p. 94).

Mathieu also maintained that there were other concerns with machine availability. Limited access to the machines may mean that the organization and scheduling of when assignments are to be due requires more careful consideration. As well, a new concern may materialize about what to do with those students who prefer to write on computer and now find it most difficult to write by hand. Finally, teachers may have to consider how to deal with the collaborative environment fostered in the computer lab that may not always be possible in the regular classroom.

A strong argument for having student writers use and perhaps even purchase laptops may be their ready accessibility. Brown et al. (1989) maintained that tools can only be fully understood through use, and people who use tools actively build an increasingly

rich implicit understanding of not only the tools themselves but of the world in which they use the tools.

Keyboarding Proficiency and Student Use of a Word Processor

If students are not proficient at keyboarding or have not learned a computer program's various commands, they will tend to underutilize the technology. Spence (1986) found that a lack of keyboarding skills slows text entry for most students, and that this inefficient text entry can hamper the ease of using a word processor. Mathieu (1989) contended that a word processor may be a new source of frustration concerning writing for those students whose keyboarding skills are not up to snuff. Such students demonstrate writing which is slower and which, because the students are not yet well skilled in using the computer's functions, show less control. Baer (1988) and Peacock and Breese (1990) found that for those students whose keyboarding skills were weak, handwriting remained a popular and quicker choice.

Weak keyboarding skills can be a concern for both students and teachers. Baer (1988) described three students who had not learned to use the computer's functions well and/or who were dissatisfied with their keyboarding skills as not enjoying word processing; they felt they could write faster and had more control using pen and paper. In her study of grade seven students, Mathieu (1989) found that, while students' keyboarding skills were improving, keyboarding was an area both they and their language arts teacher were concerned about: the students because of their lack of speed and the teacher because of the number of typographical mistakes.

Koenke (1987) found that once elementary students could keyboard 10 gwpm (gross words per minute)--the same speed at which they could handwrite--their frustrations with using a word processor for composition decreased. For high school students, the rate needed was at least 25 gwpm; otherwise their lack of keyboarding skill interfered with the composing process.

Concerning those students who are not proficient with keyboarding and who have not learned how to use a particular word processing program, how does one get them to overcome their understandable reluctance and use the technology to assist them with their writing? Leonardi and McDonald (1987), examining the writing processes of high school students, contended that teachers should wait until their students had a mastery of word processing before expecting them to be able to use the technology to facilitate their writing. Similarly, Spence (1986), who examined the effects of using word processing in the writing processes of students in Grades Four to Nine, concluded that students need time

and practice to feel comfortable with operating a word processor before they can use it as a writing tool successfully.

The hurdle seems to be getting the student-writer to be patient, to make the initial attempt and begin experiencing some degree of success with word processing his or her writing. Mathieu found that, as the grade seven students' keyboarding improved, such skills were no longer the major focus as they wrote; instead the students could concentrate on writing. The act of writing begets more writing, as suggested by Britton (1980) who maintained that, once a writer's words appear on the page, they act primarily as a stimulus to continuing.

Word Processing and the Role of Pen and Paper

Stock (1990), examining the effect of word processing on the type of revisions made by two groups of Grade 7 students, found that the word processing group made significant structural revisions, changes that were not evident in the group writing with paper and pen. Stock maintained that this higher incidence of structural revisions to a composition indicated a shift in revision strategy, since student writers primarily focus on mechanical revision, and concluded that these findings indicate that word processing is a positive alternative to the traditional paper and pencil composition instruction used to teach writing and revising.

Other studies have noted some concerns with writing being attempted exclusively with a word processor. Some recent studies (Boiarsky; 1991; Liechty; 1989; Neuwirth et al., 1990) found that writers using word processing alone engaged in significantly less preplanning, organization, and focus. This suggests that pen and paper, either alone or in concert with a word processor, would strengthen these aspects of process writing.

In addition, Mathieu (1989) suggested that, under certain circumstances, the first draft should be handwritten:

> As I walked around the classroom I saw students who were struggling with just getting a first draft written. I considered that perhaps because of the inefficiency with keyboarding of most Grade Seven students, that they should write their very first draft by hand--the thinking draft--where they could focus on what they were writing first and foremost and not on how to type. (p. 46)

In seems important to allow students to use both the old technology of pen and paper in concert with the newer technology of the word processor. Neuwirth et al. (1990) contended that writers' use of pen and paper to supplement their computer writing is not simply a habit left over from pre-computer training--as some authors have speculated--but that it meets a real need that writers have to gain a sense of their own texts.

Spelling Checkers and Style Checkers

Some researchers have viewed spelling checkers rather negatively. Wresch (1987) contended that there was no research that proved that spelling checkers were good for expanding vocabularies, and suspected that their long term usefulness in the classroom would be based more on vocabulary expansion than on spelling instruction.

Wresch also feared that spelling and style checkers would make it harder to convince some students to learn many of the basic skills. He further speculated that even teachers might be affected by the technology in that grading would become dependent on the kind of data available from style checkers.

Balajthy et al. (1990) were more positive about spelling checkers and style analyzers:

> While text analysis programs cannot provide the quality of feedback possible from a trained teacher, they can serve two important functions: First, [such programs] can perform a preliminary analysis of targeted features, allowing students to correct obvious errors before submitting a composition for review. Second, these programs can be used to perform analysis of written work that the teacher will not have time to correct in detail. (p. 31)

They maintained that, while such software programs cannot replace teacher feedback on writing, they do encourage increased writing and closer revision, provide limited analysis of composition quality and establish an effective setting for peer discussion and group feedback.

Pufahl (1986), examining the writing of college freshmen, also viewed style checkers favourably. He contended that such programs could help writers maintain more variety of word choice in their writing by helping them compile word frequency lists.

Computer-Assisted Instruction and Writing

Several studies, recognizing the apparent difficulty some students have with using a word processor to assist them in such pre-writing activities as brainstorming and planning, have explored the merits of computer-assisted instruction (CAI). Roth (1986), describing vocational college students who were having difficulty with narrowing, focusing, developing, and structuring their ideas for technical writing projects, found that providing these students with a custom-designed computer program which gave them thought-generating questions or prompts helped them in a number of ways, including being able to create a specific thesis statement and get started on their writing sooner, and being able to proceed with a clearer idea of their specific purpose.

Daiute (1986), working with seventh- and ninth-grade students, explored the effect of CAI on revision. She concluded that, while word processing alone enabled students to

skim a text for errors and inconsistencies and then improve it by adding words to the end, revision prompting enabled students to interact with the text, making deeper-level as well as surface-level revision easier. Daiute speculated that this interactive component of revision may have been necessary for students who were unfamiliar with revision and had little experience monitoring and modifying their writing.

Lamazares (1992) found that the content of wordprocessed essays produced by a CAI group rated significantly higher than the content of pencil-and-paper essays written by the same group. She found as well that the CAI group's writing anxiety became significantly lower than that of a comparison group.

At least one researcher has voiced caution about the use of CAI software. Doyle (1988), in her study of secondary Navajo students, remarked that much of the CAI software has been disappointing, calling it "the basals and workbooks of yesterday" (p. 236). When Doyle did introduce CAI programs into the classroom, it was those programs which she felt were the most creative, flexible and interactive; however, while some of the students demonstrated success using some of the "canned" software packages, most became increasingly dissatisfied and frustrated by their rigidity and impersonal nature.

Word Processing and Writing Quality

Some studies, but not all, found that unskilled writers make greater progress in writing with word processing than with conventional tools (Hawisher, 1989a). Many of these studies appraised writing quality in terms of what is measurable: such things as number of words (Hawisher, 1989a; Liechty, 1989), length of the piece (Kurth, 1987; Laidley, 1990), and the number and complexity of operations students used to revise their compositions (Collier, 1983). Such studies often concluded that many students using word processors exhibited finished products that had fewer mechanical errors than those written with traditional tools and wrote longer pieces (Hawisher, 1989a).

Several of these studies also examined such variables as "attitudes," "errors," and "syntax" by means of variously constructed checklists administered to students' writing. Hymer (1988) cautioned that any such assessment devices must be appropriate for writing assessment checklists can reflect subjective judgments.

In response to those studies which deem "language skills" as being such things as spelling and capitalization, and assess quality through such a lens, Herrmann (1987b) cautioned against appraising writing so simplistically, saying that when we focus on error or the quantity of revisions we contribute to the creation of a particle view that greatly distorts the multiplicity of factors that go into good writing.

Interestingly, many of the researchers including Christina Haas, Robert Hymer, Elizabeth Leonardi, Wendy Mathieu, Elizabeth Muldrow and Christine Neuwirth who have examined those skills which are "messy" to measure, such as brainstorming, mind-mapping, categorizing, organizing, composing and revising, and who have examined as well writing's recursiveness, are English language arts teachers.

Some researchers have offered additional conclusions which suggest some interesting possibilities concerning word processing and writing quality. Herrmann (1987b) determined that writers' predispositions as revisers or nonrevisers are more significant in predicting behavior than the influence of a word processor. She also ventured to say that quality of writing does not seem to be tied to computer usage. Haas (1987) contended that the quality of the computer system being utilized seems to affect the quality of the writing.

Does Writing with a Word Processor Create a "Halo Effect"?

Compared with some students' handwriting, and even typing, wordprocessed text looks good to the eye. Strickland (1988) maintained that a wordprocessed paper does not look like it needs to be revised: "Even freewriting on the computer looks polished" (p. 3). Does this 'looking good' aspect of wordprocessed text affect the writing in any way?

Carter (1990) speculated that clean copy may be deceiving to student writers: they might not as readily see the revisions that are needed because the piece of writing from its very first draft looks neat. She also speculated that, conversely, handwritten work appears to be less polished and more in need of revision.

Not only students may be affected by the appearance of wordprocessed text: teachers may also be affected. Peacock and Breese (1990), in their study of senior high English essays, contended that there is evidence that the difference in presentation can account for some of the perceived improvement in student writing, particularly with average and below-average work. Wordprocessed essay work tended to be graded significantly more generously by teachers, whose 'gut feeling' was that word processing enhanced the evaluator's sense of the quality of pupil's written work (Peacock, 1988).

Harris (1985), in her study of six freshman honors students, determined that word processing resulted in fewer significant revisions for those writers, exactly the opposite of the students' perceptions about their revising at the computer.

Mathieu (1989), in her study of grade seven students, found that when students thought that their work might be displayed on the classroom bulletin board, they spent a considerable amount of time typing out a final draft because they wanted it to "look good." Mathieu contended that this extra effort of typing, when most of the students are novice

typists, indicates the importance that some students place on their work "looking good," and that a printed hardcopy helps achieve this for them.

Mathieu suggests this emphasis on appearance may be a cause for concern: "Does the fact that the printout looks so good each time dissuade or encourage writers from doing further drafts?" (52).

Word Processing and Individualized Instruction

Early in the history of computer use in schools, some teachers expressed concern that computer technology might dehumanize the learning environment and reduce the student's sense of individuality. The research appears to put such fears to rest.

Greenleaf (1990), in her study of computer-assisted learning in a low-track, ninth-grade English class, found that having students use word processors resulted in instruction which was more individualized. She contended that the technology helped create a more flexible learning environment, and affected the curriculum by allowing it to become more diversified in the classroom. Seated at their computers, the class were engaged in multiple concurrent activities, and students became increasingly successful at employing varied strategies for learning and interacting with others.

Establishing a classroom environment which allows for multiple concurrent activities may be a crucial factor in individualized learning:

> By allowing students to generate their own solution paths, it helps make them conscious, creative members of the culture of problem solvers. And, in enculturating this activity, they acquire some of the culture's tools--a shared vocabulary and the means to discuss, reflect upon, evaluate, and validate community procedures in a collaborative process (Brown et al., 1989, 38.)

CHAPTER 3
DESIGN AND PROCEDURES

Chapter Overview

This chapter details various elements of the study: the design, the site, the chronology of the investigation, the selection and profiles of the participants, the ethical considerations, and the procedures for data collection, analysis, and presentation. To guarantee the anonymity of the students and teachers who participated directly in the study, I have used pseudonyms.

Design

During my graduate studies at the University of Alberta, I became increasingly interested in how word processors were affecting the writing processes of students. I read several studies which explored a variety of concerns and become convinced that I needed to learn more about the subject before I returned to teaching.

I contacted Ron Schlender, a Supervisor with the Edmonton Catholic School District and mentioned to him that I was interested in learning more about the impact of this technology on student writing, particularly concerning the effect of word processors which were portable. He invited me to accompany him on a brief tour of several schools in the District which were using Tandy WP-2 portable word processors, and I jumped at the opportunity. We visited a series of Edmonton Catholic elementary and junior high schools in early February, 1992. These one-hour visitations convinced me that exploring this particular phenomenon would be a worthwhile enterprise.

I then began work on designing a study which would allow me to explore the encounter between young writers and this new technology. To assist me in this task, I conducted a four-day pilot study at two Edmonton junior high schools in late February, 1992. The purposes of the pilot study were fourfold:

- to help me refine my research questions;
- to select a research site;
- to establish contacts with possible teacher-participants;
- to define a possible design for my case study.

Although portable word processing is being used in both elementary and secondary schools in Edmonton, grade eight students were selected as the focus of my study for two reasons:

- the students at that age were closer to the ages I had been teaching;
- there appeared to be a concerted effort at that grade level in different Edmonton schools to integrate the technology into the writing processes of students.

Borrowing from Glaser and Straus (1967), I designed a naturalistic case study which sought to answer the research questions by using qualitative methodologies to gather data--observation, questionnaire, and interview. In using multiple sources of data, I sought a holistic understanding of the phenomenon.

Borrowing as well from Guba and Lincoln (1981), I have described in detail how the data were collected and handled, and how decisions were made throughout the inquiry. Expecting that other researchers may also be interested in looking at the use of portable word-processing and its effect on teaching and learning, I have provided sufficient detail so that, as much as is possible for any study which is site- and time-specific, other researchers can use my case study as "an operating manual by which to replicate the study" (Goetz and LeCompte, 1984, p. 216).

My intention was to provide a rich, "thick" description (Merriam, 1988, 11) of the lived-world of those students and teachers who have been involved in the use of portable word-processing technology in an Edmonton school "so that anyone else interested in transferability has a base of information appropriate to the judgment" (Lincoln and Guba, 1985, pp. 124-125). By portraying this experience in detail, my study would assist the reader to apprehend more fully the act of writing as mediated by portable word processing technology.

The study's participants consisted mainly of two grade eight classes in which all students were using portable laptop word processors and six grade eight teachers who were teaching grade eight computers, language arts, math, science, and social studies to those students. From the two classes, I chose eight students as key informants who provided more specific data concerning perspectives and meanings.

The dominant voices heard throughout this thesis are of those participants most closely involved with the use of portable word-processing technology in the core subjects of two grade eight classrooms--mainly eight students and seven teachers, including the principal. As much as possible, I have presented data thematically and in a narrative form which captures the experiences of both students and teachers.

The amount of time I was in the classroom allowed me to gather a considerable amount of data. The study lasted for nine weeks, beginning April 21 and concluding June 23, 1992.

Selection and Description of the Site

The study was restricted to an Edmonton Catholic junior high school in which students were engaging in the use of portable word-processing technology to assist their writing and learning. The particular school selected, identified in this study by the pseudonym "St. Ethos Junior High School," presented the opportunity to observe two classes in which all students were using portable word processors in the core subject areas and stationary tabletop computers in a computers course. I was attracted to this school by the number of possible student-participants who could describe their experiences with and provide their insights concerning the use of portable word-processing in their writing.

I was also attracted by the amount of time the students and teachers had been using the machines. They had begun using Tandy WP-2 portable word processors at the start of that school year, and a host of difficulties and successful strategies associated with using the machines for student writing had evolved. Fresh in the minds of the participants were such things as how well the program was introduced, implemented, and supported by the school, and what factors seemed to contribute to using the machines effectively.

The study site has a reputation for academic excellence with particular attention to student achievement in the core subject areas of language arts, math, science and social studies. Such an emphasis on the academic has been partly "assisted" by the design of the school itself. Originally built as an elementary school, it has no lab space for such complementary courses as Industrial Arts or Home Economics, so the offering of such courses is quite limited.

At one time, the school was designated an "academic school" and a 70% average was set for any student who wished to enroll. Although the 70% entrance criteria was abolished later, the school's reputation has continued to attract students from a wide geographical area. While St. Ethos School had one feeder school with a single grade six class of 26 students during the last school year, grade seven enrollment for the 1992-92 school year was 118 with some students coming from the other side of the river. The school's principal, whom I identify in this study as "Mr. Redfern," commented that the distance being traveled by many students to attend St. Ethos is "kind of a proof that parents, if they find a good product, will certainly sacrifice to get that."

The study site also has had a reputation for being at the forefront of involving students in the use of computers. St. Ethos originally was one of the first junior high schools in Edmonton to offer a computer lab. At the time of the study, the school's computer lab consisted of an Apple IIe at each of the approximately 30 stations as well as a Mac Plus and a Macintosh LC with CD-ROM.

St. Ethos offers instruction to approximately 320 students. Each Grade consists of four classes. Staffing includes twelve teachers, two administrators, and one part-time counselor.

History of Portable Word Processor Use at St. Ethos

From the various teachers who participated most directly in my study, I learned how they had been introduced to the idea of involving portable word-processing in students' learning.

The decision to experiment with the idea of students owning and using portable word processors began somewhat pragmatically. The school's perception that it was unable to keep up with both student and teacher demand for access to the machines in the Computer Lab prompted exploration of other avenues. Hearing that a sister school, which in this study is identified as "St. Cosmos Junior High," had gone the route of student-purchased portable word processors, the staff at St. Ethos decided to explore that option.

The process by which the machines were implemented into the school began with the school principal and the computer teacher meeting at the school with a representative from Tandy to discuss the idea of starting a program similar to the one in place at St. Cosmos. The computer teacher then met with the teacher at St. Cosmos who was most instrumental in the introduction of Tandy WP-2 portable word processors at that school, and observed how the machines were being used. Following this, the computer teacher reported back to the staff. At a subsequent meeting at St. Ethos between the staff and the teacher from St. Cosmos Junior High, teachers heard him describe his experience with having students use portable word processors in their grade eight subjects. Following this, a half-dozen teachers of various subject areas and grades from St. Ethos spent an afternoon at St. Cosmos School to observe how students were using the WP-2 in their classes. At this point, the staff made the commitment to go ahead with a program in which students could purchase machines and use them in their various courses. Later, a more formal inservicing session lasting about two hours was held after school. This latter session focused on the features of the WP-2 and the mechanics of operating it.

Students were introduced to the idea by being given letters to take home. The substance of the letters was a description of the proposed implementation of portable word-processing into grade eight at S. Ethos School, and the purpose of sending the letters home was basically to "test the waters" concerning student and parent interest and concern. A few more letters were sent and meetings between parents and school staff, the District's computer consultant, and a representative from Tandy were held. After a few such

meetings, a financial commitment was requested from the parents. The parents of approximately seventy students agreed to purchase the machines, and most of these students were grouped into the two grade eight classes for the 1991-92 school year.

The decision was made to group those students who would be using portable word processors into two classes because it would give their teachers an opportunity to assist them better in learning how to use these machines. At the start of the school year, the teachers would give some time at the beginning of each class for the students to practice their keyboarding and to use the various functions as a group. Commented Mr. Redfern, "I think that that was possibly one of the better moves that we did make, because I know that individually they may not practice, but when they get together as a group and everybody is going the same thing, I think it does have an impact." As well, students frequently engaged in helping one another with using the new machines.

The Research Schedule

Prior to beginning my study, I undertook some preliminary research. In January 1992, I concluded a review of the literature pertaining to students using word-processing in grades four through university. In February 1992, I visited a series of Edmonton Catholic schools, including St. Ethos Junior High, and viewed how students were using the Tandy WP-2 Portable Word Processor. Later that month, I conducted the four-day pilot study of two City junior high schools, including St. Ethos.

In early April 1992, I met separately with Eugene Kozack, a computer consultant with the Edmonton Catholic School District, and with the grade eight teachers at St. Ethos to review some of the preliminary observations of my pilot study.

At this same meeting with the grade eight teachers I sought input concerning the proposed purpose and design of a case study to be undertaken at their school. Although I had envisioned the design of my study quite thoroughly, I intended for it to be flexible so that student- and teacher-participants could influence the design on an ongoing basis. I began by giving the teachers copies of my research proposal and seeking feedback from them. I continued by asking teachers for questions they might want some answers to which my study might help provide.

I sought influence on the design from student-participants as well by various means, including keeping questionnaires as open-ended as possible. In one of the surveys given to all the students (see Appendix 2) I requested, "Please offer anything else you would like to tell me concerning your use of the Tandy WP-2," and in another (see Appendix 5) I requested, "Please offer any additional comments about how the built-in

spelling checker has/hasn't affected your writing." Some of the students' responses encouraged me to look at things which I had not considered examining initially while other responses made me look at some other things more closely.

During early April I also met individually with Ms. Norris, the grade eight computer teacher at St. Ethos, to assist in the construction of a questionnaire to be administered by her shortly. Working on the questionnaire with her helped me envision and plan my own future questionnaires.

By mid-April, I had received permission from the Department of Secondary Education's Ethics Review Committee to conduct a case study and permission from Edmonton Catholic Schools to conduct the case study at St. Ethos School, and I began my formal inquiry at the school on April 21, 1992.

I initiated the formal study by meeting with the two classes which had been using portable word processors and describing my study and their possible involvement in it. Information letters and permission forms were given to the students to take home (see Appendix 1). At this time I also began processing data from the Norris questionnaire. Although I do not include any of the information from that questionnaire in this study, working on the design and processing the information generated by that questionnaire helped me design my own means of seeking written response.

Later that month I met with Glen Kirkland, the Language Arts Supervisor for the Edmonton Catholic School District to refine a series of my own questionnaires to assist in my data gathering, and I began meeting with groups of teacher-participants. I then commenced administering the first of a series of these questionnaires to the two classes using Tandy WP-2 portable word processors at St. Ethos School.

In early May I started considering student candidates as key informants, and by mid-May I had selected the eight students. At this time, I gave the teacher-participants copies of possible questions for the scheduled interview sessions, and I began the first scheduled interviews of teacher-participants.

Later that month, I started giving teacher-participants copies of transcripts of the group meetings and of their scheduled interviews. I also commenced the first scheduled interview of student key informants, a methodology which I concluded at the beginning of June.

By mid-June I had given all the student key informants transcripts of their scheduled interviews and I had concluded the last scheduled interview of teacher-participants. Later that month I received back from the student key informants and teacher-participants the last annotated copies of interview transcripts. At that time as well, I met

with four consultants and supervisors from Edmonton Catholic Schools to discuss some of the preliminary findings of my case study.

During the 1992-93 school year, I concluded a final review of the literature and completed my thesis.

Selection and Description of the Participants

The Two Classes

Two out of the four grade eight classes at St. Ethos Junior High School (identified in this study as "8X" and "8Y") were using Tandy WP-2 portable word processors which they had purchased. The twenty-seven students in the 8X class were timetabled to take music as a complementary course while the thirty-one students in the 8Y class were timetabled to take art. The former class were taught social studies by a teacher identified in this study as "Mr. Ziff" while the latter class were taught by "Mr. Duke." Both classes had the same teachers for science ("Mr. Cumulus"), language arts ("Ms. Hansen"), computers ("Ms. Norris"), and math ("Mr. Paul").

I approached both classes by meeting with them on the first day of study. I described the purpose and scope of the study and what their roles might be in it, and answered any of their questions or concerns. I then distributed an information letter to take home with a permission slip attached (see Appendix 1). Forms which were not returned within two weeks were interpreted as meaning that the parent/guardian had not given consent for the child to participate. Six students did not return their forms, and any data which had already been gathered from them was placed in a folder and marked "DATA NOT TO BE INCLUDED IN THE STUDY." The six students were excluded from any further involvement with the study. No forms were returned informing the researcher of the desire of the parent/ guardian to remove the child from the study.

The Student Key Informants

From the two classes, eight students were chosen as major contributors to this study. I felt that eight key student informants would provide me with a good assortment of experiences using a portable word processor, yet keep the study manageable. The selection of these students was based on four criteria, three of which were quite easy to meet:

One criteria pertained to character: I was seeking students with an appropriate level of maturity and dependability. The key informant candidates would have demonstrated levels of maturity and attendance behaviors to their teachers which would likely contribute to their successful participation in the study. By this I mean that the students would take

the study and their roles in it seriously. I went around to each of the teacher-participants asking them for the names of possible candidates based on the above criteria, and gathered the names of students.

A second criteria concerned the sex of the students: I was seeking an equal distribution of male and female students to make up my eight key informants. As most of our classes are populated with such a mix, I thought it reasonable to try for a similar mix in my study. I ended up choosing four female and four male student participants.

The third criteria was not as easy to achieve as the other two: I was seeking a mix of students having extensive experience with word-processing and students having more limited experience. This last criteria proved very difficult to achieve because the overwhelming majority of students in the two grade eight classes had been word-processing since at least Grade 6, some as early as Grade 3. Rather than try to fit students to this arbitrary criteria, I changed the criteria to reflect that reality of the site: all eight key informants whom I finally selected had had experience with word-processing since at least Grade 6.

A final criteria also was intended to reflect better the reality of the student access to the technology at home: some students in both classes had access to home computers and some did not, and some had access to printers and some did not. Five of the student key informants I finally selected had access to a home computer while three students did not have any access to a home computer. Six of them had access to a printer, but some of these were not compatible with the Tandy WP-2.

The field of candidates was narrowed to 12 students. I thought 12 subjects was an adequate and manageable pool of talent from which to choose the final group of participants. Each received a one-page questionnaire (see Appendix 3). I asked each of the 12 students to respond as thoroughly as possible and return the questionnaire as soon as it was convenient for them, suggesting a couple days later would be fine. Some students never did return the questionnaire while others returned it the very next day; some gave one-sentence answers while others gave responses which were several sentences in length.

The responses further assisted the selection process. Mostly I was looking for responses which demonstrated a certain degree of effort and willingness on the part of the author to discuss in detail what I was asking: I interpreted such effort and willingness as suggesting the respondent was interested in contributing to the study as a major participant. I felt that such interest was an important ingredient in what I was looking for in a key informant, as these students would have to respond to a further series of questionnaires and sit through an interview lasting approximately forty-five minutes.

Of the eight students finally chosen as key informants, three (Dawn, Gary, and James) were chosen from the 8X class and five (Alexis, Elizabeth, Rita, Robert, and Tyson) were chosen from the 8Y class. As I have done with the names of the teacher-participants and the study site, I have substituted pseudonyms for the names of the student-participants in the case study.

Alexis first became acquainted with computers at school in Grade 3, and she has been keyboarding since Grade 7. She rates her own keyboarding as "adequate to fast," saying "If we start typing our notes at about the same time, I'll finish about the same time as most people around me or just a little bit ahead." She has access to a home computer. While she does not use it for school-related writing, she uses its printer "very frequently" to print hardcopies of her work.

Dawn has been keyboarding since Grade 6 when she learned Fredwriter and MECC Writer. She rates her keyboarding as "adequate," saying "I know how to type, but not really fast.... I'm probably faster at thinking than typing." She does not have access to a home computer.

Elizabeth has been keyboarding since Grade 5 when she learned to use Appleworks and Fredwriter. She rates her keyboarding as "fast." She has access to two home computers which she uses "very frequently." She also uses one of their printers "very frequently."

Gary has been keyboarding since Grade 4, and he rates his keyboarding as "fast." While in elementary school, he was involved in "a special program which occasionally required a lot of computer use." He "frequently" uses a home computer, and he uses its printer "very frequently" to print text from his WP-2.

James has been keyboarding since Grade 6, with some attempts made at using Fredwriter and Appleworks as early as Grade 3. He rates his keyboarding as "fast." While he "sometimes" uses a Macintosh LC computer at home, its printer is not compatible with the WP-2.

Rita has been keyboarding since Grade 6. She rates her keyboarding as "fast," saying "It's fast compared to people in our class." She adds that she is usually able to keep up with her thoughts using the WP-2. She has been using a home computer since Grade 4. While she "seldom" uses it for school-related writing, she uses its printer "very frequently."

Robert first began using a word-processing program in Grade 4. In Grade 6 he used MECC Writer, and he was involved with four other students in producing a school newspaper. He started Appleworks in Grade 7. Robert rates his keyboarding as "fast," saying "I can keep up with my thinking." He does not have access to a home computer.

Tyson has been keyboarding since about Grade 6. He has used Fredwriter in Grades 6 and 7, and Appleworks in Grade 8. He rates his keyboarding as adequate, saying "I can keep up with everybody else." Although he does not have access to a home computer, he has a printer at home which he "frequently" uses with his WP-2.

The Teacher Informants and Their Programs

The only criteria I used in selecting the teacher-participants at St. Ethos School was that they were either teaching one of the grade eight core subjects or teaching the grade eight computer course. I had met these teachers initially in February while conducting a two-day pilot study at the school, and I met with them again early in April to discuss the proposed case study and their possible involvement in it. All agreed to participate in the study. The school's principal teacher, Mr. Redfern, also agreed to participate.

Again, I have used pseudonyms for the names of participants.

Mr. Cumulus teaches all four grade eight science classes, including the two classes which are using the Tandy WP-2 portable word processors. In addition, he teaches a class of grade nine science and two classes of religion. When the study began, students were finishing a unit on simple machines, and they soon began a unit on plants. In Science 8, students are taught graphing (three basic types) and frequently write lab reports.

Mr. Duke teaches social studies to two grade eight classes including the 8Y class which are using portable word processors. Mr. Duke also teaches some grade seven science, one class of religion, and some grade eight and nine art. When the study began, students were finishing a unit on the history of Canada from the time of Cartier, and they soon began a unit on Brazil. In Social Studies 8, the principal type of writing is position papers, and all the writing requires research.

Ms. Hansen teaches language arts to all four grade eight classes including the two which are using the WP-2. Ms. Hansen also teaches one class of grade seven language arts and one class of religion. She has divided her course into grammar, composition, literature and spelling. The literature component has consisted primarily of poetry, short stories, and novels. Composition has consisted of a writing program (students kept a journal for about three months beginning in September), working with sentence and paragraph structure, and writing some poetry. For most of these elements, Ms. Hansen used materials from the Perspectives Two and Perspectives in Writing: Two textbooks.

Ms. Norris teaches computers to all the grade seven and eight students as well as Math to some grade seven classes. The computer lab consists primarily of Apple IIe computers, although there is also a Mac Plus and a Macintosh LC. Students engage in a variety of projects involving the use of data bases and word-processing.

Mr. Paul teaches all the Math 8 classes, including the two classes which are using the WP-2, and two grade seven science classes. The Math 8 curriculum covers whole numbers, decimals, perimeter and area, surface area and volume, fractions, ratios and rates, percents, geometry, integers, organizing and representing data, algebra, and a review of transformations (motion geometry). Aside from doing some note-taking, students in these classes are not involved in any writing.

Mr. Ziff teaches grade eight social studies to two classes as well, including the 8X class which are using the WP-2s. He also teaches social studies to one grade seven class and to all the grade nine students. The course content is similar to that taught by Mr. Duke.

Mr. Redfern has been the school principal for the last couple of years. Besides his administrative duties, he teaches religion.

Ethical Considerations

I have employed a number of strategies to acknowledge and ensure the rights and confidentiality of those who agreed to participate in my study:

1. Potential student participants were fully informed about the study both orally and by means of an "information letter" which the students took home (see Appendix 1). The letter provided an explanation of the study and clearly outlined its purpose. The investigator met with teacher participants prior to the commencement of the study. The purposes and design of the study were described and discussed, and feedback was sought from these teachers.
2. Participation was voluntary. The information letter informed all participants and their parents/guardians that the students' participation in the study was completely voluntary and that they could withdraw from the study at any time.
3. Participants were also assured that their identity would remain anonymous. The investigator felt that this was especially necessary in order to encourage frank and honest responses from participants. To ensure confidentiality, data collected from or concerning the participants was kept strictly confidential by coding all data to ensure the participants' anonymity. Pseudonyms were created for all participants, for the two classes, and for the sites of the two schools mentioned in the study. On occasion, when I felt it was very important to conceal the identity of a teacher-participant, I identified the person as "a teacher." Participants' names, addresses, and telephone numbers are known only to the investigator.
4. While oral consent was obtained from each teacher-participant, written

informed consent was obtained from each student-participant. Attached to the information letter sent home with the students was a permission slip which acknowledged their consent to participate in the study. Written permission for the students to participate was obtained from both the parents/guardians and the students.

5. Written informed consent was also obtained from those eight students chosen as key informants. An additional information letter/permission slip outlining what the child's role as a key informant would be in the study was given to these candidates to take home (see Appendix 1). This additional permission for the child to participate as a key informant was obtained in the same manner as the previous request for students to participate.
6. All participants were made fully knowledgeable about the parameters of the study, the means by which data were to be gathered, and the possible treatment of such data.
7. Following further the advice of Guba and Lincoln (1981), for reasons of both ethics and reliability I subjected the data from the interview sessions to "member checks" in which I took data and interpretations back to the people from whom they were derived and asked them to comment on the accuracy and completeness of the material. Both students and teachers who acted as informants were kept informed by being shown drafts of relevant data-in-process: transcripts of group meetings with teachers were given to those involved for response, while transcripts of scheduled interviews were also given to both student- and teacher-informants for response.
8. Documents have been used by the investigator only for those purposes to which respondents originally have agreed to provide information.
9. The investigator continually attempted to ensure that the study did not interfere with the students' learning or the teachers' teaching, and that participating in the study would benefit both the students and teachers.
10. The investigator was aware of the ethical problems concerning the analysis of the data he was collecting. Deciding what is important and what should be included in a thesis is mostly left up to the investigator, and one might be tempted to exclude data which is contradictory to his or her desired view of the phenomenon under study. To protect the ethics of my study, I strove to adhere to the advice offered by Diener and Crandall (1978): "There is simply no ethical alternative to being as nonbiased, accurate, honest as it is humanly possible in all phases of research. . . . Biases that cannot be controlled should be discussed in the [thesis]" (p. 162).

Keeping this advice in mind, I have disclosed as much information as possible about the design of my study, the data it generated, and how such data were analyzed and presented to the reader.

Procedures for Gathering Data

As suggested by the statement of the research problem, I was interested in learning from the particular students how they were using portable word processors for writing, and in learning from particular teachers how they were responding to the presence of the technology in their classrooms. I deemed that, while involved and detached observation might assist my apprehending the nature of the encounter between participants and the technology, such vehicles as questionnaire, talk and formal interviews would help me uncover personal meanings held by the students and teachers, and provide multiple perspectives and insights into the meanings which underlie their behaviors. To gather the data from which I might answer my research questions, I designed various protocols.

Observing Students

To understand the experience of students using a portable word processor as a tool for writing, I had to learn as much as possible through a variety of different means. Included in those means was observation.

While conducting a pilot study at St. Ethos and St. Cosmos Schools in February 1991, I explored the feasibility of augmenting my observation strategies by recording onto videotape students engaging in the act of writing, as was done by Crawford (1989); however, I discovered that such a protocol was technically impossible. Unlike the word-processing machine in Crawford's study, an Apple II computer, whose design allowed the investigator to interface it with a computer monitor VCR and thereby record what was appearing on the computer's screen, the design of the Tandy WP-2 does not allow for such interfacing and recording. Further, Crawford was able to record what was appearing on the computer monitor unobtrusively: the monitor recording device was placed in an out-of-the-way location and did not distract students from their word-processing activities. To record what is appearing on the Tandy WP-2 display screen, a video recording camera would have to be placed right next to the student as he is word-processing. The video screen of the WP-2 is a liquid crystal display (LCD) which has a very narrow 'observation window': one cannot see the text rendered onto the screen very easily unless one's viewing angle is almost directly perpendicular to its surface. Such an arrangement, if it did indeed record what was appearing on the small display screen, was deemed to be too obtrusive.

I abandoned a second protocol during the beginning of my study at St. Ethos School. Initially I had hoped to employ a particular technique in which I would bring a stool into the various classrooms and observe what was going on from various vantage points. I tried this in one class and quickly came to the conclusion that it was not very effective: the stool slowed me down, I was obstructing other students, I was unable to achieve a good observing position from which I could discern what was occurring between the students and their machines, and I was not close enough to them to hear what they were attempting to say to me in a discrete voice.

The same day I abandoned the one protocol I adopted another. The strategy I ended up using successfully allowed me to be in a close proximity to the students. Borrowing from Mathieu (1989), I assumed the role of engaged participant observer, a role which involved direct observation of and speaking with the students themselves in the various learning contexts of grade eight core subjects. I would crouch down beside the student and both observe and discuss what was occurring. I could move about the room quickly, I did not interfere with other students either visually or audibly, I was able to see fairly well what was taking shape on the screen of the student's machine, and I could hear the student's remarks with greater clarity.

I also learned to refrain from having a note pad in front of me as I was talking to students. I found that students appeared to be more at ease and our conversations seemed to be more intimate and revealing if they saw that I was concentrating on listening to what they were telling me rather than assuming a more formal stance of a researcher jotting down their every word. The students understood that I would be recording what they were telling me, but as much as possible I would do this immediately after our conversations.

I would discuss some aspect of the student's writing behavior and then go either to the back or the side of the room where I would record onto a note pad what I had learned. On occasion, to make certain I was understanding correctly the information I had gathered from having observed and/or having spoken to the student, I would go back and read to the student what I had recorded as field notes. I would do this most frequently if the student's response had been particularly unique or complex.

There were times, however, when I found that I was not getting around to enough students during the course of the period, and I felt that I might be missing some important data. As well, I felt that I was becoming a bit too intrusive; some students appeared to become more interested in what was going on between the investigator and their classmates than in what their teacher had asked them to do. To assist me in finding out more about what was going on with some students and to make my presence less distracting, I began to jot down questions and hand them to the appropriate individuals. For the most part, the

students would answer them after a few minutes when they had a moment free from the particular learning activity in which they had been engaged. Rather than my waiting around and distracting students further, I would sit away from the students and work on my field notes. The students soon got into the habit of returning their responses to me when they were ready.

After a while, I found that I was writing out certain questions fairly frequently, especially in the science and social studies classes. In those classes especially, students were responding to teacher-generated questions by means of short answers composed on their WP-2s. Rather than my continuing to write out the same questions again and again, I ran off copies of the questions. For instance, I asked some students: "Can you describe your experience writing a poem on the WP-2?" I would use these printed questions to supplement both my oral questioning of the students and my continued written questioning.

Some questions were colour-coordinated. I would hand a coloured slip of paper to the occasional student, and on it would be such questions as:

- I see that you are using your laptop. Why?
- I see that you are not using your laptop. Why not?
- I see that you are reading from your laptop. Why haven't you printed out your responses?
- I see that you have printed your responses from your laptop. Why?

I feel that by the time I had begun using these question slips the students were quite comfortable with my questioning and would not have viewed such questions as being derisive or reprimanding in tone. While I can not recall specifically saying anything to the students which might have made them feel more comfortable about responding to such questions, I think I conveyed by my tone and body language that I respected however they were or were not using their portable word processors. Judging from the apparent ease with which they answered my various questions and their openness, I would say that most of the students, if not eager to respond to my queries, were at least tolerant concerning them.

Besides my note pad and slips of coloured paper with pre-printed questions, I carried about with me a clipboard which held copies of both the 8X and 8Y class lists as well as copies of the Days 1 through 5 timetable for both classes. Atop this I would affix the week's schedule of possible observing sessions. In some instances, I had written on the schedule where both classes would be during a given period: for instance, during Period 2 of Day 3, 8X would be taking science with Mr. Cumulus while 8Y would be taking language arts from Ms. Hansen. Depending on what students were doing with their WP-2s, I might visit one or both classes.

Although I primarily was interested in observing students as they were engaged in the acts of prewriting, composing and revising their writing, and noting whether and how they engaged collaboratively and how they were reading their text (rendered on-screen or as hardcopy), I attempted to observe whatever it was they were doing with either pen or word processor.

Most of my observation sessions occurred in the students' language arts, social studies and science classes, and occupied much of the first four weeks of my study. Only a few observation sessions were undertaken in the students' math classes, and these occurred during the first two weeks of the study.

Observing Teachers

My observation of teachers was primarily limited to watching for indicators which suggested that they were aware of the presence of the technology in their classrooms. I was interested in the impact of having a classroom of students utilizing portable word processors. Similar to my "agenda" for observing the students, I was primarily interested in noting the effect of the technology on writing tasks and teaching strategies. Just as in the case of my observation of students as well, I was watchful of whatever else the teachers were doing which might be pertinent to my study. Once again, my observations were recorded as field notes.

Interviewing Students Through Questionnaire

Both 8X and 8Y classes were given a number of questionnaires administered over three weeks of the study beginning in late April. Surveys 1 and 2 (see Appendix 2), which dealt with a variety of concerns, were followed by the three one-page questionnaires looking at use of the WP-2's built-in spelling checker (see Appendix 5).

Students who were candidates for the role of key informant were given an additional questionnaire (see Appendix 4) to assist the selection process and provide further data useful in the drafting of questions for the structured interview sessions.

Although several responses on the questionnaires were of the YES/NO and AGREE/NEUTRAL/DISAGREE type, frequently students were asked to discuss reasons for their responses, and several lines of space would be provided to encourage such remarks.

Interviewing Students Orally

As suggested previously, many students in both the 8X and 8Y classes were subject to questions posed by me informally. Such responses were included in my field notes.

More formal were the structured interviews. Student key informants were interviewed once during six school days beginning May 25th and concluding June 1st. Students were informed several days in advance as to when and where they were to be interviewed. They were asked to bring some of their writing as well as their Tandy WP-2 portable word processors. The appropriate subject teachers were informed in writing of the pending interview session. Students were to see their teachers at the beginning of the period they were to be missing to learn what was being covered that period and whether any homework was being assigned. At the beginning of the school day on which particular students were to be interviewed, I handed them written reminders of the interview sessions.

Interviews were conducted in the school's Guidance Office with a hallway door left open. As most students were in their classes during this time, there was minimal interruption. The student and I sat facing one another across a small trapezoid table. An audio tape recorder was positioned to the side. Interview sessions ran from 40-50 minutes, with most interviews taking about 45 minutes.

I recognized before beginning the study that some respondents might feel awkward about disclosing certain opinions and feelings in an interview (Merriam, 1988, 179-180). Recognizing this, I tried to make the climate of the interviews as encouraging, comfortable, and participant-centred as possible. At the beginning of the sessions, students were offered a sparkling fruit beverage: "Summer Peach" was very popular. I would nod encouragingly and respond "That's a good answer" or "I haven't had anyone tell me about that before. Thanks for describing that for me."

I recognized too that participants might feel pressured to respond a certain way to my questions, to agree with whatever I was suggesting. I was particularly aware of this risk whenever I employed a strategy to encourage responses from some key informants who turned out to be somewhat hesitant to respond in an interview setting. The strategy I occasionally employed with reserved respondents during the interview sessions was to seek their reactions to certain scenarios rather than answering particular questions: for example, I might offer a description of how a person might use a portable word processor such as the Tandy WP-2 for gathering information for an essay, and ask them whether that vignette described their use of the machine. However, I recognized that some shy respondents might be likely to agree with my interpretation to avoid elaboration or

describing alternatives. To minimize the risk in using this strategy, I would try to make the respondent feel that it was all right to disagree: I would either preface or postscript the description by saying such things as, "Now, let me know whether this is part of your writing process or not..." or "Now, feel free to disagree with this observation...."

I prepared for each interview session by going over all the data which had been generated by and was concerning the particular key informant. In the case of the students, this included responses to various questionnaires (some written by all participants and some written by the key informants only), brief written responses to written questions I had handed to the students during various classes, and any other relevant notations.

Structured interview questions (see Appendix 7) were prepared. With the exception of the first few questions, I did not follow the questions in any particular order; rather, they served as a touchstone for the interview sessions. As much as possible, I tried to make the necessity of my having to find answers secondary to the important task of permitting the student-respondent to make meaning of his or her experience of using a portable word processor for writing. My focus, then, was to listen carefully to what the student was expressing and to make certain that his responses demonstrated clarity and completeness. By often a circuitous route, most if not all of the interview questions were covered--as well as many more besides.

Interviewing Teachers Orally

Teachers were interviewed both informally and formally, in groups and individually. Throughout the duration of the study, I asked teacher-participants for their insights into what I was observing or hearing from the students. These informal oral exchanges occurred during class time, lunch hour, or after school--whenever it seemed opportune to both the teacher and myself--and were brief and specific.

More structured were the interview sessions involving more than one teacher-participant. I met weekly with two groups of teachers beginning the end of April and concluding the middle of May 1992. This 'group talk' was scheduled so that teachers could anticipate and look forward to such regular exchanges. All such meetings were held during a lunch hour. With Ms. Hansen, Mr. Paul and Mr. Ziff, I met three times; with Mr. Cumulus and Mr. Duke, I met twice. Ms. Norris, the computer teacher, joined two of these sessions. Mr. Redfern, the principal teacher, I met with individually. All such sessions were tape-recorded, freeing me from having to take notes so that I could be more fully attentive.

With these group sessions, discussions centred on their observations and questions concerning student use of portable word processors, as well as some of the findings which

the study was generating and their possible meanings. Questions asked and responses given by the teachers proved invaluable in assisting me to sharpen the focuses and modify the design of my inquiry.

Most structured were the formal interview sessions in which I met with teachers individually. These sessions were held beginning May 14 and concluding in mid-June. Most of the structured interview sessions were conducted after school; one was held before school began in the morning and another was held over a lunch hour. As with the scheduled sessions involving students, I tried to make the teacher-respondent the centre of the interview: although I had particular questions to which I sought answers, the route we took in discussing the various focuses was largely determined by the interviewees themselves.

Data Analysis Procedures

While data gathered by questionnaire and informal discussions contributed significantly to the study, data gathered during formal interview sessions with the eight principal student-participants and with the seven teacher-participants formed the bulk of the material used to fulfill the study's main purpose.

Initially, I assembled my data into four categories, each examining one aspect of the act of writing: prewriting, composing, revision/editing and collaboration. As I gathered more data and my thesis began to take shape I developed other headings which explored additional aspects emerging from the study (see pp. 65-66).

The Questionnaires

In reading the students' responses to Surveys 1 and 2 (see Appendix 2), I was looking primarily for student responses which would reveal a broad range of experiences with using portable word-processing. Such experiences would include both successful and unsuccessful use of the tool for different types of writing and for different stages in students' writing processes. For the most part, I have provided in this study the responses of the eight key informants only. Where a student other than a key informant offered a response which I considered illustrative of another facet of the nature of the encounter between students and the WP-2s or of the experience of using the machines for writing, I have included the remark and identified the respondent as "a student."

As mentioned earlier in this chapter, a third survey (see Appendix 3) was given out to a limited number of students: its purpose was to assist me further in selecting the eight students who would be key informants.

Questionnaires A, B, C, and D (see Appendix 4) were given to the eight student key informants. Data was gathered from these questionnaires and used in concert with data gathered from individual interviews. In Chapter 4, I indicate occasionally whether a student's statement was a written response or a spoken one, but for the most part I have attempted to meld such responses to create a more fluid, seamless discussion of participants' encounters and experiences with the technology: to me the substance of the discourse, not the means by which it was communicated, is of paramount importance.

Questionnaires asking students about their use of the WP-2's built-in spelling checker (see Appendix 5) were given to all students. While I have mostly provided data from the eight key informants, I have attempted to summarize the use of the user's dictionary based on the responses of all the students.

With all responses given by students on questionnaires, I was watchful for clarity and completeness. During the study, and especially in the context of the structured interviews, I would ask students for additional responses based on their initial statements. At times, certain written responses of students contradicted other responses, either written or oral, and I would seek clarification and, if necessary, correction. As most students correctly understood the questions being asked of them and answered with a satisfactory degree of clarity and completeness, such further questioning by the investigator was minimal.

The Transcripts

As much as possible, all remarks spoken by participants and recorded onto audio tape were transcribed verbatim. Some initial remarks concerning student word-processing experience or the programs which teachers were offering were not transcribed but were entered onto a "profile sheet." The remainder of the interview questions and responses were transcribed.

Transcripts of the interview sessions were provided to students between June 10th and 17th, and to teachers between May 19 and June 22. Each student key informant was given two copies of his or her particular transcript (see Appendix 7). Students kept one copy and returned the other. Similarly, teacher participants were invited to respond to their respective copies of the transcripts, and return a copy if its text required revisions or corrections. As emphasized below, such revisions were invited to assure accuracy and completeness of response.

Presentation of the Data

In addition to melding responses to questionnaires with data from interviews, at times I have woven a participant's earlier remark made informally in the context of the classroom with a later remark offered in the context of a structured interview. Again, the reason is to create a coherent readable text which tries to present a holistic understanding of a phenomenon.

To assist my readers, I "smoothed out" some of the verbalizations. Anyone acquainted with how human speech looks when rendered into printed text will appreciate the necessity of making the spoken word more intelligible. Below are some examples of how data taken from transcripts of interviews with student key informants have been revised by the investigator to make them more "reader friendly."

For example, originally I may have rummaged around with how to pose a question until it came out sounding like this:

Original (Rough) Question:
Later on--you prefer to wait until later in your writing to use the spelling checker--when you're finished writing a rough draft--you use it then?

A student's response may be an equally interesting study in cognitive groping:

Original (Rough) Response:
Ya, I like doing it, like, instead of, like, come, like, after each paragraph, instead of, like, spell checking it, um, I'll do it, like, right at the end.

In such an instance, I would attempt to make such questions and statements more coherent as follows:

(Revised) Question:
You prefer to wait until later in your writing--when you're finished writing a rough draft--to use the spelling checker?

(Revised) Response:
Yes. Instead of spell checking it after each paragraph, I'll do it right at the end.

At times, the revision has been assisted by the key informant. I requested that each informant read over a copy of the transcript of his or her interview session, and check it for accuracy. As shown below, in some of the transcripts I noted for the key informant where in the text I felt that there was a problem with clarity or completeness.

Original Question:	Original Response:
What about the idea of a word processor that is always with you? Why is that "IMPORTANT" to you? Besides notes?	Probably because I didn't want to have to write it out and then go over it with [**NB**: Do you mean "enter it onto"?] the computer. I don't like looking at the page and then having to type it out.

If the student agreed that he or she meant "enter it into," I would revise the response. Such revision would be communicated to the reader through the use of square brackets. In the above instance, the student agreed that the revision more accurately captures what was being expressed, and, for the purpose of this thesis, the response is rendered as follows:

(Revised) Question:	(Revised) Response:
What about the idea of a word processor that is always with you? Why is that "IMPORTANT" to you? Besides [for taking] notes?	Probably because I didn't want to have to write it out and then [enter it onto] the computer. I don't like looking at the page and then having to type it out.

As shown above, I may also have attempted some revision of the question. Such revision would have been prompted by my having noticed some incompleteness of thought. I have added "[for taking]" to what I said to the student to make things clearer for my reader.

At other times, incompleteness of thought may be even more obtrusive. While I may have been able to understand the student's original response because of the particular context established several minutes earlier in the interview, a reader focusing on a smaller portion of the transcript might find a particular exchange confusing.

Originally the exchange may have sounded like this:

Q: Have you ever had someone look at it and give feedback?	R: Yes. Only with handwritten.
Q: What was your response?	R: Unless it was really important, I wouldn't bother.

To assist my reader, I might render the exchange in this manner, once again employing the use of square brackets to signal to my reader that some revision has been made:

Q: Have you ever had someone look at [your writing] and give feedback?	R: Yes. Only with handwritten [work].
Q: What was your response?	R: Unless it was really important, I wouldn't bother [making changes to my writing].

At times, I have removed some text which was redundant or irrelevant. I have indicated such editing by the use of ellipsis. For example, a teacher describing a group writing activity might say the following:

> And I noticed the revision or changing of answers. They all gathered around, and one person would read, the person with the laptop would read what the answer was, what they had written down, and they would change it or whatever if they had to.

To assist my reader, I would render such a response in this manner:

> And I noticed [too] the revision or changing of answers. They all gathered around, and... the person with the laptop would read what... they had written, and they would change it.

For purposes of simplicity, clarity and consistency, student responses such as "Yup," "Ya," and "Uh-huh" were rendered as "Yes," while student responses such as "Uh-uh," "Naw," and 'Mm-mm" were rendered as "No."

In addition, student nonverbalized responses to a question have been rendered as "(student nods)" or "(student shakes head)." On occasion, when the student has offered no response, I have written "NO RESPONSE ."

As stated previously, for the purposes of clarity and completeness I have also woven in remarks offered by the students in the context of responding to questionnaires. Where the length of such remarks has been more than just a few words, I have identified that the remark was made in the context of responding to a particular questionnaire. The same "rules for revision" as I have indicated for the treatment of interview transcripts also applies for the treatment of responses to questionnaires.

I have also attempted whenever necessary to establish the typicality of the case: in such instances, I have described how typical or atypical the event is compared with others in the same class so that users can make comparisons with their own situations (Goetz and LeCompte, 1884).

In spite of the aforementioned editing, I feel I have presented an accurate rendering of the speech present in the structured interview sessions. As much as possible, usage has been preserved to capture the personalities of the participants and the essence of the exchanges.

Arranging the Data

The next chapter, Chapter 4, is a collection of the voices of those students and teachers who have experienced what it is like to write with a new tool, the portable word processor. A considerable challenge for me was to categorize the considerable data generated by this descriptive/exploratory study, and arrange it in such a way that would minimize redundancy and yet still capture what it meant for the participants to use such a technology.

The final arrangement I chose is reflected in the chapter's main headings:

- Writing and the Portable Word Processor
- Collaboration and the Portable Word Processor
- The Impact of a Portable Word Processor
- Integrating a Portable Word Processor Effectively
- Issues and Assessments

CHAPTER 4
ANALYSIS OF THE DATA

Introduction

This chapter presents data gathered from nine weeks of observation and interviewing at St. Ethos Junior High School. Such data reflect the direction of inquiry prompted by the research questions. In answering the research questions, I have sought to provide a rich, thick description of what have been the experiences of both the student- and teacher-participants having used a portable word processor in their grade eight classes. While I have tried to include throughout this chapter the voices of the study's many participants, for reasons of economy I occasionally present data concerning one or two participants which are fairly representative of the comments of others whose experiences have been similar.

Some of the data have been categorized under headings which correspond to the various stages of the grade eight students' writing processes -- specifically their prewriting, composing, revising, and editing processes -- and to the use of the technology in their collaborative strategies. Although in this chapter I have attempted to include the data under such particular headings, my experiences in the field have illustrated amply to me that such arbitrary compartmentalizing is at best artificial. However, for the sake of making a complex phenomenon more apprehensible, I have chosen to attempt such compartmentalizing, trusting that the reader will recognize the "elasticity" which exists within each section.

The Data

The data presented in this chapter were evoked by four of my five research questions.

The initial part of the chapter explores answers to two of my research questions:

1. What is the nature and meaning of the experience for students and teachers using portable word processors for writing and learning in the particular grade eight classrooms being studied?

2. What insights into the writing of grade eight students can be gained from the behaviors and comments of students using portable word processors in their core subjects?

In posing these two questions, I sought to learn about the act of writing as experienced by grade eight students at the study site and the manner in which a portable word processor

had been affecting such writing. The section of the chapter which explores the data generated by these questions is titled: "Writing and the Portable Word Processor."

The data presented in the latter part of this chapter were in response to two further research questions:

> **3. What sort of impact has the presence of a portable word processor had on the teaching/learning situations at a particular school?**
>
> **4. What factors contribute to effective use of portable word processing, and what do we need to provide in the core subject classrooms to assist students in using the technology effectively?**

In posing the third question, I sought to learn how this technology, and in particular its portability, affected changes in the writing strategies of students and the teaching strategies of teachers. I explore such data in the section titled "The Impact of the Portable Word Processor." In posing the fourth question, I sought to learn some possible ways in which teachers can provide an environment in which the student-writers may use such a tool more effectively. I explore such data in the section titled "Utilizing a Portable Word Processor Effectively."

To conclude the chapter I present data which pertains to all the above sections. This final section is titled "Issues and Assessments."

Writing and the Portable Word Processor

Prewriting

Prewriting may include such actions as brainstorming (listing, thought webbing), researching, planning and outlining.

Gathering Information

Generating ideas -- listing.

In response to whether pen and paper or a word processor offers one a better means of engaging in brainstorming, two key informants (Rita and Elizabeth) offered contrasting responses. Rita found that at times the WP-2 worked well at assisting her with listing ideas:

> Sometimes for brainstorming I sort of prefer typing it. We did this exercise in class where you turned the contrast [on the WP-2 screen] down and you just typed all the ideas that came to you.... I found it a lot easier than writing with pen because we didn't have to worry about what we wrote or the spelling mistakes. We just typed it all down.

Elizabeth found that pen and paper makes it easier to format her brainstorming because she can add whatever text she wants. She found it easier to write columns of words with pen and paper; when she has attempted to do that with the WP-2, she has found that "the words get mixed up and you can't finish this one word because you haven't given the column enough room to finish, and it's going to go on the other line." I wondered whether, for her, formatting on the machine distracted somewhat from the act of generating ideas, and she agreed that it does.

Elizabeth also has found that at times she is distracted by the act of keyboarding, for it interferes with her jotting down ideas: "Sometimes... if I'm having a slow morning I can't keyboard as fast as I'd like. It's interfering with my flow." She agreed that at times when she finds her keyboarding is sluggish she says to herself, "All right then, I'm just going to use pen and paper," and she abandons using the machine.

When I asked Ms. Hansen, the language arts teacher, for which areas of prewriting she thought the WP-2 might be used most successfully, she enthusiastically responded: "I think they can be used really successfully if the students choose the right technique. Listing is probably the best one."

Generating ideas -- thought webbing.

Three key informants (Rita, Elizabeth and Dawn) spoke about their experiences using the WP-2 for thought webbing to assist them in planning their writing. Typical of their comments were those offered by Rita. While she favours using her WP-2 for creating a list of ideas, Rita has found it preferable to use pen and paper for constructing a thought web: "You can do webs and you can show your ideas in a whole bunch of ways, and that's a lot easier on pen and paper." Rita felt that creating a thought web on her WP-2 is counterproductive. She has found that she has to concentrate more on the mechanics of how to put things onto the screen rather than concentrating on the substance of her mind map:

> On the word processor, to make it actually work good, you have to write the word, you have to go down a couple of spaces, write the word, and then move a whole bunch of words around it, and that takes a lot of time. Then you're losing your ideas because you're taking all the time moving... using the space bar and moving [things] all over the place.... You're thinking of how you have to order it so it looks good, and then you're forgetting all your ideas of what you're writing about.

When I suggested that it sounded as if attempting to construct a thought web using her WP-2 tended to interrupt her flow of thought, Rita agreed, saying that with pen and paper her ideas flow more. Dawn offered a second reason as to why creating a thought web with pen and paper is advantageous: "If you had it on your word processor, you'd have to take time to print it out, but if you had it on pen and paper, you'd have it right there."

Researching data.

Gathering research data is a necessary skill for grade eight students, especially in such courses as social studies and science. Mr. Ziff commented that in grade eight social studies "all the papers require research," while Mr. Cumulus stated that at least one of the writing tasks in grade eight science class also involved gathering information.

When asked about the extent to which their students were taking their WP-2s into the library to assist them in compiling their data, both Mr. Cumulus and Mr. Duke, the other social studies teacher, offered observations. Mr. Cumulus commented that, for one particular report he had assigned on fractional distillation of crude oil, many of his students were taking their WP-2s into the library and gathering data directly onto their machines. Contrastingly, Mr. Duke responded that only a few students in his class were using their machines for this purpose; the rest of the students tended to gather their information using pen and paper or by means of photocopying.

Turning to the key informants, I sought their comments as to whether a portable word processor such as the Tandy WP-2 was a suitable tool to assist a writer in gathering data. Three of the key informants (James, Rita and Tyson) offered their opinions. While none of the three expressed a strong conviction that the WP-2 was a suitable tool for such a task, James came closest to endorsing its use for gathering information for essay writing: "Because the WP-2 is portable, you can take it with you to do research at the library."

When asked to elaborate on his comment, James gave a more neutral impression, one which was shared by Rita. Both key informants offered that when they are gathering information for a social studies paper they have no particular preference which writing tool they use. They use either pen and paper or their portable word processors at this step in their writing processes. James said that when he is planning an essay he will take either tool with him into the library. Rita responded, "If I'm writing a report for social, I'll either bring my laptop to the library and I'll type down some notes or I'll just grab a pen and I'll write down some notes."

Tyson, on the other hand, had a definite choice of tool for gathering information: pen and paper. He had used his WP-2 for gathering information only once, and he felt that the experience had not been a productive one: "It takes a long time to organize [the notes].... It would take a long time just to make it look good and space it and everything. [With] pen and paper, you just jot it down quickly from line to line."

Planning and Organizing

Responses to questionnaire.

In one of the questionnaires I gave to key informants (see Appendix 4), I asked two questions concerning planning as part of their writing process. One question asked,

"Does the WP-2 encourage planning?" Seven of the eight students responded, three saying "YES" and four saying "NO." Some of the responses were quite weak (see those of Tyson, Dawn and Robert below), perhaps illustrating a problem with the question and/or the limitations of these grade eight students responding to a written questionnaire.

In responding in the affirmative, three key informants (Rita, James and Tyson) offered various reasons why they felt inclined to plan their work using the WP-2. Rita responded: "It's easy to plan or brainstorm notes written down or already printed out.... It's easier for me to organize my notes if they're printed out in front of my face." James said: "Because you can type quickly, planning doesn't take as long. This encourages you to try some planning." Tyson offered this comment: "It encourages [planning] because it not only allows me to get it done faster, it is neater and more legible than my writing resulting in a better composition."

Those students who felt that the WP-2 did not encourage planning had a variety of reasons for their responses as well. Two students provided rather weak answers: Dawn said that she had planned her compositions prior to ever purchasing her WP-2, and Robert offered that the WP-2 only helps in editing and making the writing more pleasant to the eye.

Elizabeth too responded "NO," but provided a reason which was more thoughtful. She said, "You don't have to have a certain plan; you can just put down whatever you want and you can still change it afterwards." I wondered whether it might be more accurate to say "The WP-2 does *not* encourage planning during *prewriting* ," and she agreed, saying "I plan after I am finished typing all my ideas onto the WP-2. I don't care which order they go in before that. After I am done I use the cut/paste option to move around things." She added that, when using pen and paper, most often such planning is undertaken earlier in her writing process.

Gary was the fourth key informant answering "NO," and provided responses which explored the issue more broadly. To him, the WP-2 does not encourage planning because he finds the eight-line screen too small, too limiting: "When I plan, I like to have full sheets of paper, I like to have big diagrams and all that stuff, but with the WP-2 you're limited to just eight lines. You don't have a whole piece of paper, so it's really tough to do planning on the WP-2." I suggested that perhaps he likes to see the "big picture," and he agreed:

> I like to see the whole thing on a [full-size] sheet--not just eight lines.... It's easier for me. I get the whole picture. I don't have to scroll, scroll, scroll, and have it all come at me little by little. I just like it to hit me like all at once. I can skim through the page real quickly [rather] than having to keep scrolling."

Gary further commented that, while he felt that his portable word processor presents certain limitations concerning planning essays, he also felt that a tabletop computer would encourage more planning because its 32-line screen would offer more text.

Gary also noted that, if he were doing his planning with pen and paper, he would already have his hardcopy and he therefore would save some time:

> I think the main reason for [one's having] the WP-2 is to save time. So, if you're going to [choose between] doing two steps with the WP-2, typing it out and then printing it, or just [one step] using a pen and paper, writing out all your ideas on a piece of paper would save time.... [That's why] I'd rather use the pen and paper.

Gary also felt that the WP-2 does not encourage planning because it limits one's formatting options and takes more time. "You can't draw any lines," he said. Sometimes when he writes he likes to comment about something he has said by drawing a line from his text and jotting down his comment. Gary added, "you can't add special things" such as "arrows and circling things and that stuff... like my own kind of personal language." Gary further maintained that, if he were using the WP-2, he would find it necessary to "print out first and then write notes on the page," another time-consuming action.

A second question on the same questionnaire asked **"Compared with pen and paper or a tabletop computer, how much does the Tandy WP-2 portable word processor encourage planning?"** Once again, some of the respondents seemed to have difficulty giving responses which answered the question (hindsight reveals that there are actually two questions here); however, four key informants did answer it with some degree of success, three (Tyson, Dawn and Elizabeth) saying "AS MUCH" and one saying "LESS."

In saying that all three writing tools would encourage planning "AS MUCH," Tyson offered a response similar to those shared by two other respondents: "It encourages it just as much because planning is a necessary thing for writing and it really doesn't matter what I do my planning on."

Gary responded "LESS." His reasons were similar to what he had elucidated earlier:

> With pen and paper, you can do things on the side, draw lines, and so on. A tabletop has a larger screen, but you still must print and you still can't add special things. The tabletop is almost like the WP-2. Again, I'd rather use pen and paper because there are no limitations.

Planning and organizing -- when, why, how.

To further my insight into the writing of grade eight students, and to obtain clearer responses to my inquiry concerning planning and organizing than had been elicited by means of questionnaire, I pursued the topic of planning and organizing during the interview sessions. I asked my key informants when in their writing processes they were concerned

about such matters and at what point they were using their portable word processors. Three students (Dawn, Alexis and Tyson) offered responses, each one different from the other.

While Dawn uses the WP-2 for her prewriting, it is the hardcopy generated from her WP-2 which she uses to assist her planning. She initially uses her portable word processor to gather data for essay writing; however, she prefers not to organize her ideas by manipulating them on the machine. Instead, Dawn prints a hardcopy of all the information she has gathered, and uses it to plan her paper. She then uses arrows, numbers and symbols such as asterisks "for putting things in order." Dawn says that with the printed hardcopy "it's easier... I can see everything all at once." Echoing Gary's comment mentioned earlier, she too finds that the screen on the WP-2 is too small for her to organize her work.

Alexis' response suggested that organization was something which occurred later in her writing process. She said, "I think that it makes it easier [to organize text on the WP-2], because you don't have to be rewriting all the time, you can just move [things] around." When asked if that meant that she is less anxious, "less wanting to get it right the first time," she responded, "Yes, because you know that it's easy to move things around, so you're not really worrying too much about it."

Tyson's comment, echoing those stated by Alexis and, earlier, by Elizabeth, was that with essay writing he usually brainstorms and plans as he is composing his text. He responded, "I don't lay out a plan. I just write as I am thinking." I mentioned that this reminded me of some comments from other key informants--that they are discovering as they go about writing a story--and Tyson agreed that in much the same way he is discovering as he is writing an essay.

When I asked Tyson to explore further his thoughts concerning planning, it became clear that the availability of a portable word processor does <u>not</u> seem to have influenced how he plans his essay writing. Tyson typically writes a "junk draft" using pen and paper. Once he has written out this initial draft, Tyson begins his planning, putting squares around certain paragraphs and using arrows and numbers to indicate the order in which he wants to situate his paragraphs. The availability of a portable word processor has simply meant that, following these other steps, he transposes his organized paper onto his word processor.

<u>Outlining and the WP-2.</u>

To further my understanding of how these grade eight students were planning their writing and what role their WP-2 portable word processors played in such planning, I asked the student key informants specifically whether they constructed an outline and whether their machines played a role in such a stage of their writing.

Typical of the planning strategies followed by the key informants were those voiced by Robert. If he is writing out his initial draft with pen and paper, Robert numbers his paragraphs and arranges them into an order. At other times, if he has gathered information onto his WP-2, Robert will do his planning right on the machine using the cut and paste functions to move text. He takes the paragraphs he has created from the "chunks" of information he has gathered and then, he says, "I'd probably arrange [them] in an order that I like."

Teachers' observations of students' planning and organizing.

As I was gathering information from students about the place of planning in their writing and the role of the WP-2 in such planning, I shared with two of the teachers some of the data I had gathered. I mentioned to both Mr. Ziff and Ms. Hansen that some of the students whom I had been interviewing were recounting that they tended to plan their writing as they were composing it. I asked Mr. Ziff whether he had observed that there were any students for whom planning occurs as they are writing rather than occurring prior to writing an initial draft. He responded: "I suppose, yes, but usually I find that the poor essays are as a result of planning as they are writing.... It's quite disorganized. I don't know whether it's a matter of just not taking the time to organize or whether it's just an inability to do that."

I also asked Ms. Hansen whether she had observed students engaging in such planning while they were composing. She was unable to provide much illumination: "I can't say I've noticed anything like that because most of the time they would be doing their writing at home or outside of class time. We would work on a concept, and they wouldn't have enough time in class to get the actual writing done."

I further asked both Mr. Ziff and Mr. Duke, the other social studies teacher, to compare this year's social studies classes, including those using the WP-2, with those of other years insofar as organization in their writing was concerned. Mr. Ziff responded in this manner: "In terms of planning, there isn't much difference between the two [grade eight] classes." When I asked Mr. Duke whether, because the WP-2 can move, add, delete and change text very readily with its cut and paste functions, the machine might be affecting students' writing in terms of organization, he responded that he had found that to be "a main difference." In his opinion, there was a certain strength in organization with students using the WP-2, as demonstrated by a recent essay which his students had completed:

> I randomly read [the latest papers]. I took a look at the better papers from the [class which isn't using portable word processors] and I compared them with the [class which is using them].... I had them both hand in their rough copies too, and I noticed a lot more revision in terms of sentence structures and the organization of the paragraphs [in the papers] of the [WP-2 class] versus the [class without WP-2s]. Whether it's because of the laptops, I'm not sure....

As a teacher who has taught only Grades Ten through Twelve, I wondered whether students at this age group are still learning about coherence, about sequence and logic. I asked Ms. Hansen how well, in her opinion, students in Grade 8 understand such concepts as sequence and chronological order, and she responded "I'd say fairly well." I then asked her if she had notice any difference this year concerning coherence with the students who had the portable word processors --whether it was any better or any worse compared with other years. She responded:

> I can't say it was any better. I think in a way it was better last year because we had spent more time dealing with unity and coherence.... I didn't do as much of that this year... Maybe [it was better last year] because of the nature of the child or the fact that we just didn't have time to get to it because there were other things.

The role of hardcopy in planning.

When I asked the student key informants to describe specifically what it was that they were printing as hardcopy from their portable word processors, they mentioned several things. Typical of their responses was the list offered by Gary: "Just all the plans, all the work and stuff I've done, and all the stuff I've written down... my ideas [and] brainstorming."

Gary in particular offered some interesting comments on the importance of hardcopy in student writing. To him, printing out a hardcopy of his evolving text is not an option; it is a necessity: "You really don't have a choice," he said. "You must print it out." Gary conceded that one could plan on the WP-2, "but it's difficult." He added, "You have to type it out--that's the first step. And then there's a second step to it, [the printing of the hardcopy,] so it takes a bit more time." Gary also commented that the availability of printers in the classroom was limited, and that this impacted negatively on planning: "If you can't print out, there's no sense planning on the word processor."

The role of printing hardcopy also had a curious effect on whether students in the two grade eight classes used their portable word processors for such things as brainstorming or outlining. I observed that for shorter tasks such as brainstorming or outlining, most of the students did not see a benefit to using the machines unless they were going to be printing something out.

Seeing as how much of what we call prewriting might not ever be printed out as hardcopy or handed in by a student, I asked Ms. Hansen what she had observed concerning using the WP-2 for such writing activities. Ms. Hansen responded: "They know that they can run off a hardcopy and then work on their hardcopy when they're doing their writing. But they just don't want to do it... because it's not important enough." She added, "I guess we have to work harder on making them understand that prewriting is more important than the actual writing itself."

I then mentioned to Ms. Hansen that, in interviewing my key informants, I began to sense that some students were reluctant to print a hardcopy until they had a polished piece of writing. I asked her to speculate on why they might not be printing a hardcopy until the end of their writing process. Ms. Hansen responded by saying that students' reluctance to print hardcopies at different stages of their writing process was a result of their concern about the environment: "I don't think it's because they are [all] thinking 'I'm wasting paper,' but some of them think that way." She said that when it came time to printing out a polished draft of their work there were always one or two students who were concerned enough to ask her, "Can I print on the back?"

However, Ms. Hansen felt that a more frequent reason was that students did not see the value of printing hardcopies at different stages of their process. She remarked: "It's very hard for them to do that because [they think] that's not what you are supposed to do... even though on occasion I said, 'I would like to see a copy run off, and I want to see your changes made on it. Hand in the rough draft with the changes.'" As a result, she said, "They will not print until it's ready to hand in.... I think that's mostly what they are thinking.... You only print if it's perfect." I responded to her statement by wondering if, for some of these students, running off a hardcopy of a rough draft might be a relatively new concept, to which Ms. Hansen replied, "Yes, I think so."

At this point in our discussion, I mentioned that some students had told me that they prefer to print a hardcopy early in their writing process so they can see what it is that they have been writing. They had commented that this is done especially with longer pieces [because] they are having difficulty seeing their writing on that small screen. When I asked them if they were attempting to get a "big picture" of their writing and gain a sense of where they were in its development, they agreed that was what they were attempting to do. When I asked Ms. Hansen whether some of her students had suggested something similar to her while they were writing in class, she replied that, while she had not seen or heard such a response, she could imagine that such was the case.

Composing

Students' Composing Processes

Several of the student key informants spoke to me about their composing processes using a portable word processor for the writing of short stories and essays.

For Elizabeth, when it comes to the act of writing a story, she plans out her piece before she begins writing it:

> For a short story, I would probably think of something I wanted to write about, some of the things I had found most interesting, that people would find interesting in reading my story. And I would think about what order I would put things in,

> like how I'm going to do my climax and how I'm going to put together all the information I need to get a certain feeling about my story.

When I asked which writing tool she usually uses to plan her story, Elizabeth responded "Putting it together would be on the word processor, but planning what I'm going to put together and how I'm going to put it together would be on pen and paper."

Robert, described a very different process for composing a short story. He said that he does not sit and plan it out first: "I just start writing it. If any ideas come into my head, I add [them]." I wondered whether this meant that he was discovering as he was writing, and he agreed that such was the case. When asked about which tool he might use for the act of composing a story, Robert indicated he did not have a preference.

Elizabeth's composing process for writing an essay is a bit different from her story writing. She agreed with my paraphrase of what she had been telling me: her story writing process is "rather orderly" and "linear," while her essay writing process is a bit more "chaotic." She described this process, saying that she initially creates a number of categories or focuses that will eventually make up her main topic. Skipping back and forth among these focuses, she then puts down all the information which she might use in her paper: "I talk about one thing and then go on to another. I can move them afterwards. I can write down whatever I want whenever it comes to my mind." Elizabeth agreed when I suggested that it sounded as if, when she is composing her piece, she might be developing things which interest her at a particular moment. She added that all the while she is concentrating on staying on topic: "Whatever comes about that topic, I just put it down and rearrange it afterwards." Unlike her process for writing a short story, she does not worry about the order in which things should go in an essay "because I want to get that idea in there before I forget about it."

I asked whether she wrote papers this way before she began writing with a word processor. Elizabeth responded: "No, because I didn't want to copy it out over and over again with my pen and paper. It was too hard. So this way I can rearrange it and I don't have to make two copies of it." When she was writing papers totally by hand, she tended to work more from an outline. She would put her efforts more into preplanning her work. Being able to use a word processor has meant that she tends to focus more on ideas initially and worry about organization later. She goes from her rough ideas directly into developing and composing, delaying the organizing, the cutting and pasting, because of the technology:

> Using pen and paper, I would tend to use jot notes, putting down my ideas, and then I would put them into sentences and paragraphs and rearrange them in the right order. And then I would write them down. [Now] I just write down whatever sentences I want to and then I rearrange them on the WP-2.

Gary 's description of how he writes a paper for social studies suggested that his process for essay writing is a bit more step-by-step than Elizabeth's process. He described it in this manner:

> You usually start off with organizing all your thoughts, doing your research in the library, and then just basic knowledge that you had learned yourself, and type it all down or write it down onto the WP-2. Then, after you have all that, if you have time, just put it all into like organized columns. You can have headings, and once you have your headings, you just go to the word processor and then you skim quickly over your notes, and that will hopefully trigger something in your mind, it'll bring it all back up, and you just type away.

In a file on his WP-2, Gary would be scrolling up and down, moving back and forth between the information he had gathered onto his machine and the piece that he was composing: "I'll use the 'Control-›' keys and 'Control-fl' keys and see what I've written, and then look at the notes, and all that stuff."

Gary's response prompted me to ask a further question: rather than scrolling back and forth and trying to remember what was in his notes as he did his writing farther down in the file, did he ever compose where his notes were, working them into a paragraph? He answered, "I try to remember what was there, then I do some writing later on in the paper." At this point, Gary also mentioned that another process he has often used is to print his notes and place the hardcopy beside him as he composes on the WP-2. For him, it was a more convenient process which saves him time.

Composing and the Choice of Writing Tool

Students' observations.

In composing their writing, students may use different writing tools for different types of writing tasks. When I asked the student key informants what their choices of tool were for composing an initial draft of their writing, I soon realized that I had not been asking my question correctly. The students' responses made me recognize that their choice of tool for composing their writing depended on the type of writing which they were attempting. Their responses focused on the writing of essay, poetry and short story.

When the student key informants were asked about their choice of tool for expository pieces such as essays and reports, two of the key informants told me that they prefer to compose their initial drafts using a word processor. Dawn prefers using her WP-2 for the rough draft of an essay because it is faster than pen and paper. Its speed is important to Dawn: "I can get all my ideas down at once." Further, it saves her time because she does not have to rewrite complete drafts of her writing. If Rita has used her WP-2 for jotting down notes for an essay, she will continue using the machine for composing her initial draft: "If I have my notes done on [the WP-2], I print them out so I

can see them in front of me, and then I just take the notes and put the information into sentences on my laptop."

Speaking specifically about their preferred tool for composing poetry, several of the students said they prefer using pen and paper for their initial drafts. James said that "poetry is expressing emotions," and that he found a machine such as the WP-2 to be "a bit impersonal." Another student commented that although she liked writing poetry on a tabletop computer with its various fonts, she found the WP-2's single font and its smaller font size to be less appealing. A third student commented: "Because I am still getting used to writing with this machine, I find it a lot easier to write on paper first."

Several students also commented that they prefer composing with pen and paper rather than with the WP-2 because they like to see their text all at the same time. Typical of their responses were those offered by Elizabeth: "Lots of times with poetry I have to have it in a certain format, and it's hard to visualize what it looks like when it's on the screen and you can't see all of it at the same time." For Elizabeth, the WP-2 becomes a useful tool after she has attempted her first draft of a poem: "Afterwards I may put it onto my word processor as soon as I know how I'm going to [arrange] it and which way it's supposed to look."

Contrastingly, several students said that they prefer writing poetry using the WP-2. One student commented that she can "just write a poem off the top of my head and it's in my laptop." She added that having it written on her WP-2 was handy because she can "decide to revise it from there or delete it." Several students also commented that they like how they are able to format their poems using the machine. Typical of their responses were those offered by one student who stated:

> When I type my title I boldface and underlined it so that it will stand out more. I use the tab key and the spacebar key to space the poem out, along with the centering command. To make lines stand out, I use underlining and a lot of bold letters. I also use cut and paste. Finally I activate the spell-checker to [look] for spelling errors. I like typing my poems [on the WP-2] because it is very fast, easy, and it is very neat.

When it came to choosing which tool they preferred for short story writing, most student key informants were ambivalent. Typical of such students' responses were those voiced by Rita. For writing a story, Rita had no predetermined preference: "I usually like writing a story with pen first, because I can just start writing and it will just come to me. But then sometimes I can just grab my laptop and I can just type away."

James, however, was more definite about preferring to use his WP-2 for short story writing. Comparing his experience of writing a story with pen and paper and writing a story using a word processor, James said: "It's a little more enjoyable to write with the

computer because you can go much faster, you don't get [writer's] cramp, you can make changes, [and] it always looks neat."

Two other student key informants also responded to my question about choice of tool in ways I had not predicted, but their considerations had little to do with the type of writing being attempted; rather, they felt that the choice of tool for composing depended on other variables.

James told me that his choice of tool for composing depended on the length of the writing he was doing. While he writes shorter pieces or paragraphs on his WP-2, for pieces of writing over two pages, such as essays or stories, James usually prefers writing at home on a Macintosh LC. His reason for this is similar to that voiced by Elizabeth: "I like seeing more of the work at a time. It's easier to tell when you have a page and things like that." He added that the Macintosh LC presents more lines of text (32 lines) than the WP-2 (8 lines).

Alexis said that what might influence which tool she would use for composing an initial draft is "if there's class time given." If such time is provided, she will begin writing her initial draft on paper and then she will transfer her text onto the word processor; otherwise she will create her initial draft on the machine.

Students' responses also illustrated that a determiner in the choice of writing tool for composing was the degree to which the student-writer felt comfortable using a particular tool.

For Robert, it was important for him to have already done some word processing: "Sometimes if it's early [in the day] and I'm not warmed up yet, I'll use pen and paper." I wondered whether, if he had taken notes or done some other writing in another class and his brain and fingers were warmed up, he might be more inclined to use his word processor, and he agreed that was likely.

Rita conceded that she may at times prefer to compose with a pen simply because it is a familiar tool: "It's sort of habit [to write with pen and paper], and I'm more comfortable and familiar with it." However, at the same time, Rita recognizes the advantages of using a portable word processor for her composing: "I think I prefer doing it on my laptop because there is not as much work involved."

Rita also mentioned that she finds that there are times when ideas come a little easier with pen and paper compared to working with her word processor: "I guess [it's] because I'm used to it. All the years I've always been writing with a pen. I guess with a pen you don't have to worry about your keyboarding mistakes. It's more comfortable." When I speculated that such a reliance on pen and paper may be partly out of habit she agreed, but

she also felt that there might also be something in the familiarity of a pen that makes the ideas "come easier."

Several students also offered another remark concerning writing tool and comfort: when they use their WP-2 for composing, they do not experience "writer's cramp."

Teachers' observations.

To supplement what the students had been telling me about their choice of writing tool for composing, I invited Ms. Hansen, the language arts teacher, to share her observations concerning students' choice of tool for writing an initial draft, asking her whether those students owning WP-2s prefer writing their first draft with the machines or with pen and paper. She responded: "I don't know.... I think it might be [with the WP-2s] if I said, 'I want you to do it on your laptops.' If it were left up to them, most of them [would] probably do it by hand."

I also asked both Ms. Hansen and Mr. Duke whether they had been insisting that students use their portable word processors for certain stages of their writing processes or that students hand in work that was wordprocessed or typed. Ms. Hansen responded that, while she had made a point of encouraging her students to use their WP-2s for various writing activities and at various stages of their writing processes, it was only their "polished writing" that was required to be handled in this manner. Mr. Duke responded in a similar fashion: "Personally, I think I'd probably favour that it be used as an instrument to create the final draft." Instead of instructing his students to use their portable word processors at particular times or in a particular manner with their writing processes, he "sort of left it up to them," adding, "I can't say that I've consciously tried to encourage [its use] at any point in the process."

Revision and Editing

Revision

Before I spoke with the student key informants about the revision processes using the WP-2, I spoke with three of the teachers, Ms. Hansen, Mr. Ziff and Mr. Duke. They offered their observations concerning the revision their students were attempting in their writing.

In this study, **revision** is that step which involves rethinking what one has written --its ideas, organization, diction and sentence effectiveness--and making choices which involve the addition, deletion, rearrangement and/or substitution of material.

Teachers' responses.

I asked Ms. Hansen, the language arts teacher, if she expected revision to be done at any particular stage of the students' writing. Ms. Hansen responded that she had not

made any demands as to when such revisions should be attempted: "Some of them would get all their ideas down as paragraphs and then go back over them. Others, even rank beginners, were revising on the spot as they were writing." When I commented that this seemed to suggest that the students' writing processes, or at least their revision strategies, were somewhat idiosyncratic, Ms. Hansen agreed: "I think so. Whatever they preferred and whatever worked for them."

I also discussed with Mr. Ziff the extent to which his social studies students, those in the one class using the WP-2s and those in the other using pen and paper, were engaging in revision strategies. He responded: "Not as much as I would like them to. [The essays they hand in are] more first-run type of things." When I asked whether his grade eight students were tending to such aspects as precise diction and effective sentence structure, and moving text around to make a work more coherent, Mr. Ziff responded: "They are doing it, but not to the extent to which they should be doing it."

When I spoke with Mr. Duke, the other grade eight social studies teacher, he said that he had noticed some difference between the earlier drafts and later drafts of his students' writing, more in terms of reorganizing ideas than revising diction. When I asked whether his students were revising their work in order to provide more support for ideas. Mr. Duke answered: "Not usually, no... I can think of maybe one or two cases where they were skimming over their rough copies... [where] a point that wasn't made very well was elaborated on, but on the whole... it's usually just cleaning up grammar and punctuation." I asked if this revision was in terms of both handwritten and wordprocessed writing, and he answered that it was. When I asked Mr. Duke whether he thought that that kind of lack of revision, or limited revision, seems to be characteristic of the age of the students, he responded "Yes."

Responses to questionnaire--when and how students revise.

After I had spoken with the teachers, I gave each of the eight student key informants a questionnaire which explored certain aspects of revision (see Appendix 4). The questionnaire began by offering this definition of revision: "Changing something by means of adding, taking away, moving, or changing." Most of the student key informants offered responses to the first question which asked when and how they revise their writing.

In describing their strategies for revision, Dawn, Gary, and Alexis said they would make such revisions during both the composing and the concluding of their writing. Typical of their remarks were those voiced by Dawn who said that, while she seldom reorganizes her planning as she is composing, she at times will make other revisions to her work: "Sometimes I don't think it sounds right, so I want to change it." At other times, Dawn works on revision toward the end of her writing process. When Alexis offered a

similar remark, I suggested to her that it sounded as if she was not reluctant to interrupt her composing in order to look after some revision concerns, and she agreed.

Three students (Tyson, Elizabeth and Robert) said they would prefer to leave such revision until the end of their writing process. Fairly typical was Tyson's remarks when, discussing why he prefers to wait until he is finishing his writing to edit his text, he said, "I like to get all the structure down, and then look at [whether] the words make sense or [if] I want to have a better word in there."

Although the questionnaire asked about revision strategies, two student key informants, Rita and James, offered comments which focused more on editing rather than revision. I have included the remarks of these two students in the section on "editing" below.

Editing

In this study, **editing** is the act of polishing a rough draft, reworking the words, phrases and sentences, and checking for the correct use of conventions of English such as capitalization, punctuation, subject-verb agreement, consistent verb tense, and pronoun reference and agreement. In the contexts of questionnaire and interviews, six student key informants described their strategies for editing their writing.

(As the Tandy WP-2 Portable Word Processor features a built-in spelling checker, I also asked the students about how they were using this feature; however I have included this data under the separate heading "Using the WP-2's Built-in Spelling Checker" beginning on page 84.)

When and how.

Five of the student key informants, in describing their strategies for editing their writing, said they would make corrections to their writing at the conclusion of their writing processes.

Two students, James and Elizabeth, suggested that making corrections as they were writing would be too distracting for them. Both James and Elizabeth commented that they correct their work later in their writing processes because they don't want to lose their train of thought. Discussing this further, Elizabeth said that she felt that it was important that she maintain the flow of her writing, and that editing during her composing process would interfere with that flow:

> I wouldn't do any spellcheck or anything in the middle, or worry about my grammar, because [then] I can't get back into what I'm talking about. If I'm in the middle of an idea and I've done something wrong, I'm not going to go back until the end because I don't want to stop what I'm doing.

I suggested to Elizabeth that it sounded as if she wanted to maintain the momentum of her writing, and she agreed.

In describing her process for editing, Rita commented more directly on the role of her portable word processor. Describing a two-stage approach to editing, she said: "I [edit] before printing a hardcopy or when I am finished a piece of writing.... I spellcheck using my WP-2. I then print out a hardcopy [and] correct the punctuation, structure, etc. Finally I add my corrections to my writing on the WP-2."

Tyson's editing process also involves two stages, but both are completed right on the WP-2. When he has finished writing an initial draft on his machine, Tyson begins his editing by first running the spelling checker and then reading over his text for errors in punctuation.

Only one student, Alexis, said she would make corrections to her writing during both the composing and the concluding of her writing. Alexis first stated that she views editing as a final stage in her writing process: "That's probably the first thing I'll do. Before I hand it in I'll go through it with the spell checker, and [I'll] make sure I've got capitals and periods and whatever." However, having said that, Alexis also recognized that she edits as she composes "if I notice something." Sometimes, if she is not quite certain of a word's spelling, she will type what she thinks is its correct spelling and then run Spellword. When asked whether she minded disrupting the flow of her composing by thinking about spelling correctness, she responded "No." Alexis concluded by offering that correcting as she is writing happens less frequently than looking at such things as spelling correctness at the end of her writing process.

Using the WP-2's built-in spelling checker.

The Tandy WP-2 portable word processor is equipped with a built-in spelling checker. The function called "Spelldoc" allows the writer to check the spelling of an entire piece of writing. The program scrolls through the text, and if the program finds a word which it determines is misspelt or unknown, it highlights the word and a menu appears on the screen offering four editing options. The "Spellword" function allows the writer to check the spelling of a single word. If the program does not recognize the word, it may list some alternate spellings or offer the prompt "Not found." The "Auto spell check" function is used when the writer wants the WP-2 to beep each time he or she types a word which the machine does not recognize. (For a fuller description of the spelling checker functions on the Tandy WP-2, please see Appendix 6.)

Each of the eight student key informants was given a questionnaire which explored when and how they used their WP-2's built-in spelling checker (see Appendix 5). All eight student key informants responded that they tend to check their spelling after they have finished a draft of their writing.

Typical of their experience is the process described by Rita: she prefers to run the Spelldoc function to check the spelling of an entire document when she is finished a final draft and before she runs a hardcopy. When I asked if such a strategy was more convenient for her, she replied: "Yes. Instead of spellchecking it after each paragraph, I'll do it right at the end."

Rita also mentioned that she will on occasion use the "editing" option (see Appendix 6) when she is running the Spelldoc function:

> When I know the word is just a typo, and I know how to spell it, I'll just edit it.... If I have no idea how to spell the word, or if I'm just too lazy, I'll just [choose] "correction." Or if it says "Not found,"... I'll usually edit it and type it out to see if it's right, and then I'll Spellword it again, and it should say it's "Correct."

Elizabeth finds using the Spelldoc to be more helpful "because it not only tells me [a word] is [spelt] wrong,... it also tells me how to spell it [correctly]." Conversely, "with the beeping spellcheck I can sometimes re-spell the word five times before I get it right."

Six of the students offered negative comments about using the Auto spell check while they were writing. All six keep the Auto spell check turned off, and mentioned specifically that they do this because they find the beeping sound "annoying" and/or "distracting to others."

Tyson mentioned that the beeping of the Auto spell check was only part of what he found distracting about this particular function: besides being annoying, the beeping sound "would make you go back and correct [the] word." Reflecting on the earlier remarks offered by James and Elizabeth, I asked Tyson whether he felt that "something like correcting spelling would be another train of thought," and whether he wanted "to stay on one track instead of bouncing back and forth," and he responded "Yes, exactly."

Using the Auto spell check did not seem a popular strategy. Both Dawn and James commented further that their teachers do not like it when students are writing with the Auto spell check turned on. Commented Dawn, "Sometimes the teachers think it is too noisy [to have on]." Dawn added that she had never tried writing with the spelling checker turned on. Only one student, Robert, professed to using the Auto spell check regularly, saying he used it for note-taking.

Seeking a response from the teachers as well, I asked for their observations concerning how student were using the WP-2's built-in spelling checker. Mr. Cumulus commented: "I sure hear them go off every once in a while." He had noticed it being used mostly when students were "watching the screen and they are doing their typing or they're answering questions or whatever, and all of a sudden they hit the wrong key." He thought that "a lot of them do not use [it] as a spell checker," instead, they use it as "a typing checker." Ms. Hansen observed that students used the WP-2's spelling checker in two

different ways: "Some of them would do it with their [Auto] spell check on as they were going along, and others would wait until the end. Again, whatever worked best for them."

Diction

Diction and the use of a spelling checker.

In a brief questionnaire given to all students in both classes using the Tandy WP-2 portable word processor (see Appendix 5), I asked students to respond to this statement: **"Using a word processor with a built-in spelling checker has encouraged me to use difficult-to-spell words in my writing."** Students could offer one of five responses ranging from "STRONGLY AGREE" to "STRONGLY DISAGREE" with a provision for a "NEUTRAL" response. In addition, they were invited to offer reasons for their responses. For most of these students, Grade 8 was the first year in which they had used a word processor with a built-in spelling checker.

Three of the students (Tyson, Elizabeth and Gary) responded "STRONGLY AGREE." Tyson's comments illuminated the way in which all three were using their portable word processors, while Elizabeth's and Gary's comments described the effect on their diction of having such a machine conveniently at hand.

Tyson commented: "When I don't know how to spell a word that I want to use, I just put it the way I think it is supposed to be spelled, and after I'm finished writing I go back and check the word with the spell checker." I asked whether that meant that he does not concern himself so much with spelling correctly as he is writing, leaving that concern for later, and he agreed.

Elizabeth, who describes herself as a "strong speller," discussed what would have happened previously, before she had a word processor with a built-in spelling checker. She responded that, regardless of the writing tool she was using, "I wouldn't have used [such words] because I didn't want to go look it up in the dictionary."

Gary, who also rates himself as a strong speller, commented: "I don't have to drag a thick dictionary around to see if this new word is spelled right. The WP-2 tells me, and it shows me where I went wrong. [As a result,] I have begun to use words that are new and difficult to spell." Gary added that the WP-2 has saved him time because "the dictionary is so readily accessible" He also claimed that, because it saves him time, "I have become more creative in my writing."

Two of the students, Rita and Dawn, responded "AGREE" to the question posed. Both responded in very similar ways to the previous three informants. Rita said: "When I'm typing, I know [that] if I use difficult-to-spell words, I will check them after I'm done writing." Dawn, who describes her spelling as "strong," commented: "[The WP-2]

encourages me because now I can use 'big' words without having to hassle with looking through a dictionary. Most of the 'big' words I use are a result of the built-in thesaurus."

Two key informants, Alexis and James, were "NEUTRAL" in their assessment of whether the WP-2 encouraged them to use difficult-to-spell words. Alexis, a "strong" speller, offered a reason which seemed to suggest that the spelling checker in the WP-2 is fairly limited in its ability to interpret some of the words one has misspelt: "Sometimes if you use hard-to-spell words and you have only one letter that is wrong, it'll say 'Not found' on the display [screen]." The reason offered by James, who rates himself a "very strong" speller, was quite limited: "I may use bigger words now, but I can't remember if I have." In an interview he was able to expand upon this, saying "If I'm writing and I'm not sure how to spell a word, in the past I've used a less... a not-as-good word.... Now with the spellcheck I don't have to worry about that." When I asked James if he meant that he may be more inclined now to use words which are more difficult to spell, he agreed.

Only one of the key informants responded "DISAGREE" to what was being asked. Robert commented, "I just don't use difficult words. If I don't know how to spell it, chances are I don't know the meaning of the word." I asked Robert, who sees himself as "an above average student when it comes to spelling," if he felt that he knew how to spell most of the words he knew and that he was able to use them in his writing without using the spelling checker, and he answered "Yes."

Diction and the built-in thesaurus.

I felt that in asking students about their use of a spelling checker it would also be pertinent to ask about their use of the thesaurus which had been built into their WP-2s. I wondered about the effect on student writing of a tool which had a thesaurus built right into it, thinking "Ah, here's something that might be a boon to students who are contemplating the effectiveness of their diction." Four students responded about this aspect of their word processor, with Rita and Dawn speaking favourably.

Rita spoke of using the WP-2's thesaurus in two ways: As mentioned previously, Rita commented that she uses her thesaurus so she can look up a word and find "another way of saying the word instead of using the same word all the time." She also said that she uses her thesaurus to help her find the word she wants as she is composing.

Dawn said that most of the time she uses the WP-2's thesaurus as she is writing. One feature she liked was it's ready accessibility: "You don't have to go and get [one]. It's there when you want [it].... I can easily highlight the word I want to change and press [F1] -[7] for a selection of synonyms." When I asked what she thought of stopping her composing process and calling up the thesaurus, she responded that she did not mind.

Elizabeth and James, offered comments which suggested that the WP-2's thesaurus was not a boon to their writing. Both seldom use the feature. Elizabeth said that she uses the thesaurus "once in a while," but she finds that it, like the dictionary, is fairly limited: "It doesn't give me very many [synonyms]--maybe four or five." James echoed this assessment, saying that the few times when he has attempted to use the thesaurus "it always says 'No synonyms found.'"

Revising and Editing One's Text: Reading From Hardcopy or Screen?

Six of the eight student key informants told me that to revise their work effectively they preferred printing a hardcopy of their text and making changes to it. Overwhelmingly, these students offered two reasons for this opinion: the necessity of seeing their text in its entirety and the greater readability of text which has been run off.

For writing both an essay or a story, Robert needs to see his text in front of him in its entirety before he makes any changes. He said that printing a hardcopy "lets me view the whole article at one time (the screen is too small)." If he is composing on a tabletop computer, he does not feel the same need to print out a hardcopy for revision: "The screen is larger, so I can see more."

Rita too likes "seeing the whole [thing]." She said that, while she usually would edit a first draft of her work by making corrections directly onto the WP-2, for revising her work she would print out a hardcopy. She commented further:

> I always like seeing it in front of my face... because sometimes if you look at the screen, you'll just read through it really quickly and you won't really pay attention to it. I guess my eyes sort of deceive me when I'm just seeing it on the screen. But if I print it out,... it's clear and I can see the whole, all that I have written.

With this printed text beside her, she would do some cutting and pasting. When I asked her if she preferred printing a hardcopy of her rough draft and revising it, Rita responded that she did, and then she went on to describe her process of revising and editing her hardcopy:

> I can read it slowly, and I can fix the rest of the mistakes, including my punctuation.... If I don't like how my sentences are structured, I can just circle the word[s] and move [things] and [draw] arrows. And then when I'm done that, I can easily just look right at the corrections and I can just type them back into my laptop.

Rita also spoke about how she would pay particular attention to the completeness of her ideas:

> I'll go over it and I'll think, 'I haven't showed this idea to its fullest,' and I'll write in some stuff on the side of the paper, and then I'll just add that after. That's what I did with my Louis Riel essay. I [initially] didn't show why I thought he was a hero at the end. I had to show why he was a hero, and so... I went over what I written, and then I thought a little more about it, and then I just typed it in after.

For Elizabeth, the advantage of working from a hardcopy for the purposes of revision was its readability. She said that she found the WP-2's liquid crystal display a hindrance: "It is hard to read over your work because of the small screen.... Flicking down every line, I find I lose my place too easily." Consequently, she usually prints a hardcopy and then makes changes to her text.

When I asked Tyson why he might run a hardcopy, he responded: "It's easier to see the sentence structure... compared with just [seeing it] on the WP-2." Scrolling his text screen on the WP-2 made it difficult to see individual sentences, whereas with a hardcopy he could see such sentences better. He also said that he found it was easier to cross out words and sentences on his hardcopy with a pen and to reorganize paragraphs by drawing arrows indicating where things should go than make revisions directly on his word processor.

The remaining two student key informants, James and Alexis, offered answers quite different from the other six.

James does not usually print out a hardcopy of his text for the purpose of revision because he usually composes his longer works at home on a tabletop computer. When asked if the screen on that machine seemed to show enough text for him to make effective revisions, he said it did. He added that the only time he would run off a hardcopy of a longer piece would be "when it's all finished."

Alexis did not see much value in printing out a hardcopy that was not the final draft of her writing. She responded: "Occasionally I will if [the teacher] wants to see our first draft, second draft, final draft, whatever, but other than that no." At this point, Alexis reaffirmed that she prefers to scroll back and forth, making changes to her text on the WP-2.

I asked Ms. Hansen, the language arts teacher, whether she had observed students printing a hardcopy during their writing process and making changes to that hardcopy. Although what she had been able to observe was fairly limited as students were expected to complete their assigned writing tasks at home, Ms. Hansen responded that she had. However, she felt that most students seemed to be of the attitude that, once they had run a hardcopy, it was "done." She agreed with my suggestion that this might mean that she most often would be seeing hardcopies that are finished products rather than works-in-progress.

Further Issues Concerning Revising and Editing with a Portable Word Processor

Does the WP-2 encourage revision?

I wanted to explore whether the WP-2 Portable Word Processor affected student attitudes towards revision. In one of the questionnaires I gave to student key informants (see Appendix 4), I asked a few questions concerning revision as part of their writing process. One question asked was "In your opinion, does the WP-2 encourage revision?" The students were asked to choose between answering "YES" or "NO," and to discuss reasons for their responses. All six of the student key informants who responded to this question answered "YES."

Three of the students (James, Rita, Gary) drew attention to the cut and paste function. Typical of their response was the remark offered by James: "You don't need to rewrite everything.... [It] makes it easy to move sentences [and] paragraphs around."

While the question asked about revision, two of the students remarked further about the machine's capacity to assist with editing. Rita said, "I think it encourages revision because you can use its dictionary and thesaurus to change or correct words." Drawing attention to a previous remark of his concerning using the built-in spelling checker as well as cutting and pasting, Gary remarked, "As stated above, the WP-2 has some special commands designed for editing." He added, "because we mainly check the spelling, [such features] make editing about 80% easier, if not more."

Two students also remarked that a revised piece of writing was not messy, implying that a piece freshly revised would look good--good enough to be handed in without recopying. Dawn remarked that the WP-2 encourages revision "because the WP-2 makes it easier to revise, since it is not messy (no white out or scratch outs) and it doesn't make your writing look crowded or have empty spaces." Gary, responding further, said, "your paper is not messed up when you do revision on the WP-2, because what you print out is typed, neat, and correct."

Is more time spent on writing using the WP-2?

In a questionnaire (see Appendix 2) given to all the students in both classes, I asked: **"Compared with the writing you did in Grade 7 without the portable word processor, how much time did you spend to complete a writing assignment this year using the Tandy WP-2?"** Students could respond "More," "As Much," or "Less," and they were asked to provide a brief explanation for their response.

Six of the eight student key informants claimed that they spent "Less" time completing an assignment in Grade 8 using their WP-2s. The most frequent reasons they

offered for spending less time included being able to type faster than they could write (Elizabeth, Gary, James, Robert, Tyson) and not having to write out both a rough draft and a polished draft (Dawn, Elizabeth, Gary, James, Robert). Also credited with saving time was the built-in spelling checker (Elizabeth, Gary, Tyson).

Alexis, whose response was both "More" and "As Much," echoed the comments of others concerning not having to write out several drafts: "Most assignments now are longer than last year, but... it would take about the same amount of time.... You don't have to go through so many things until you finally come up with your draft, because you don't have to be rewriting and rearranging for hours."

Rita responded that she was spending "As Much" time on her writing. She too commented about not having to write out multiple drafts of her work: "I used to write it all out, and then I'd type it all out, so that would... take twice as much time because I'd have to do it twice."

I asked several of the key informants whether, because they were now working with a rough draft which they were refining and making into a better draft, they were using the time to make corrections and revisions to their writing. However, students' remarks focused more on the aspect of making corrections rather than revisions, a characteristic of the students which I have discussed previously. Fairly typical was Elizabeth's remark: "It takes much longer to handwrite and correct and rewrite than it does to type and then correct with the spelldoc and then just print." Tyson too offered a comment which focussed on editing rather than revision: "After I am done [writing] I can go to the spell checker and correct all errors. Rita answered in a similar fashion: "When you use a pen and paper,... you can't do what a computer does. You can't go back and fix it up to hand it in. With the WP-2, you can make your rough draft your good draft.... You can look over your rough draft and you can just fix it up."

Is there a reluctance to revise and edit?

While my student key informants maintained that they were concerned about making effective revisions and doing thorough proofreadings of their writing, their teachers Ms. Hansen and Mr. Cumulus offered a different assessment about such practices by the grade eight students at St. Ethos as a whole.

As mentioned previously, Ms. Hansen was of the opinion that her students were "in too much of a hurry" and that "they just want[ed] to get something done." Expanding further on what she had said, Ms. Hansen added that she found that the students edited their work very poorly:

> Some of the better students were very conscientious and made all the changes they could, [but] I would say at least half of them didn't do anything; they left it as it was, almost like, 'I know where the mistakes are, but [why bother].' I found that

> they didn't change it in a lot of cases. I was quite disappointed with what they came up with.

Ms. Hansen offered an explanation as to why most students did not make the changes: "I think... that some of it was they had to search a little bit. I said, 'Go back in the book. Go in your notes. See what you should have done here. Do a little bit of research.' They're not willing to do that." When I suggested that her students might be hoping that she would be their editor, she agreed that might be the case.

During another discussion with Ms. Hansen, she offered a further insight into the reluctance of some students to revise their own work: "I think some found that it was more work than they expected it to be. They expected the machine would do everything, and then they found out that they really have to work with this."

When I asked what sort of work she was envisioning that these student might not be wanting to do, Ms. Hansen answered: "Revision, editing, cutting and pasting--just anything...." Her impression was that some students were reluctant to have to go back and look again at their writing. She felt that students viewed such things as adding a few more ideas and rearranging things to improve one's writing as being too much work.

I thought it was ironic that some students would view a portable word processor as something which condemned them to toil away at writing rather than seeing the boon offered by this technology in making the revising of text so easy. Ms. Hansen added that many of her students found it difficult to understand why anyone would want to spend time working on a series of drafts:

> I explained to them that when I was student I would write maybe six or seven different [drafts]. I would write a rough draft, and I'd make my revisions, then I'd rewrite it and make revisions to that. They couldn't understand that, because [to them] you write it once, and you do all the revisions on the same copy, and if you have to rewrite it then that's your final copy.

When I asked Ms. Hansen if she knew of any students who would take their writing through a number of drafts, she responded that there were some: James and Gary came to mind. To those names I added Rita whom I had watched take a social studies essay through a number of drafts. When I suggested that the majority of students still demonstrate an attitude of "I've run a copy and it's finished" or "I won't print a hardcopy until I think it's done," Ms. Hansen nodded.

I told Mr. Cumulus that one of the things I was exploring was the extent to which the students are making improvements to their writing, and asked him what his observations were. Echoing Ms. Hansen's earlier comments, Mr. Cumulus responded: "Right now, it's more or less typical junior high mentality [of] 'If there's an assignment, let's get it done as quickly as possible, [let's] get it out of the way.'" He added, "I imagine

there is the odd one that does go back and says, 'This doesn't quite sound right,' or 'This could be said in a different way.'"

I decided to pursue a bit further with these two teachers the issue of students' reluctance to revise, focussing more on their thoughts concerning the ability of their grade eight students to undertake the act of revision.

I asked Ms. Hansen for her opinion as to which aspect of writing--revision or editing--students at this age had more difficulty with. "I think revision more," she answered, "because [with] editing they will go back and check spelling and that sort of thing. I think that revision is difficult for them."

When I mentioned to Mr. Cumulus the difficulty which some students seemed to be having with understanding that writing is more than correctness, and improving one's writing involves more than simply editing, he responded that one has to be aware of the level of ability when one teaches students of this age: "In terms of this specific science course,... part of that difficulty is not having sufficient background in a particular concept or principle."

Collaboration and the Portable Word Processor

As collaboration between students engaged in the act of writing may occur at any "step" in their writing processes, the data presented here complement data presented earlier in the chapter. This part of the chapter illustrates four things:

- the frequency of collaboration in the writing processes of the grade eight student participants at St. Ethos Junior High;
- the nature of such collaboration ;
- the role that the WP-2 portable word processor has played in the collaborative strategies of these writers; and
- the role of hardcopy in such collaboration.

A point of clarification: in using the phrases "collaborative writing" and "collaboration," I am referring to students helping one another with their individually authored texts.

The Frequency of Collaborative Writing at St. Ethos

In speaking with both Ms. Hansen and the students and in observing their language arts and social studies classes, I noted that the students had been working in pairs with "writing partners." The grade eight students had been choosing friends or classmates close at hand to help them with their writing. Five of the eight student key informants said they

collaborated fairly regularly with another classmate and offered remarks which suggested that such activities were an important part of their writing process, regardless of whether or not they were using their portable word processors.

When I asked several student key informants how frequently collaborative talk was a part of classroom writing activity, their responses were mixed. A few suggested that it was only occasionally a part of their in-class writing experience. Thinking specifically about his experience in language arts, Gary added that such collaboration is not part of a process in which every student engages: "It's up to us."

When I asked Rita about the amount of time provided in her courses for collaboration, she emphasized that two of her courses provided for such opportunities. She commented that her language arts teacher regularly allowed for such activity: "Ms. Hansen lets you think of ideas and then she [says], 'You can work with a writing partner and discuss your ideas.'" In social studies, Rita said, collaboration was also expected: "Mr. Duke gives us time to write reports and essays and short answers, [but] he doesn't exactly say, 'You can go with someone.' You just automatically go and talk to your friends and we discuss ideas that you can use."

I asked Mr. Duke and Mr. Cumulus for their assessments concerning the extent to which such collaboration has been a part of their programs. In posing this question to Mr. Duke, I described a possible instance in which students might exchange their works in progress or a polished draft of their writing to get feedback on the ideas, and then I asked him whether he has observed such collaboration. He replied:

> If it happens, it would be only in exceptional cases. I can't see that happening very often unless it was encouraged by me, [and] it hasn't been.... I've encouraged revision, [saying] "Have someone else read it," not necessarily another student, [but] a parent or another teacher.

I asked Mr. Duke whether that meant that he had not attempted a strategy in which he had said to his students, "Your paper's due on a Thursday. Make sure you've got your rough draft finished by Wednesday," and had his students read each other's rough draft. Mr. Duke replied, "No, I haven't, but it's a good idea."

I asked Mr. Duke whether he had ever seen his students exchange their WP-2s and read each other's text as rendered on the display screens. Although he was unable to offer any comments about his 8Y social studies class, he stated that he had seen the 8X class, his homeroom class, exchange machines: "[They did so] oftentimes in the mornings... before the bell [when] an assignment was due. I'm not sure if they were copying off each other or if someone was just taking notes." He agreed with my assessment that "in terms of really collaborative efforts in writing there really isn't too much right now with these students."

The lack of such collaboration in the writing being done in grade eight science was confirmed by Mr. Cumulus. When I then asked him whether he had ever seen his students pass their portable word processors or a hardcopy of their writing-in-process to another student to read what they had written, Mr. Cumulus replied: "Very seldom. It does happen once in a while, but not near to the point where you have a regular routine."

The Nature of Collaborating with Writing Partners

The Collaborators

Of the five student key informants who collaborated fairly frequently with a writing partner, Gary's remarks were typical of the experience. His remarks concerned collaborating with a partner in the language arts class. At the suggestion of his teacher Ms. Hansen, the 8X language arts class would team-up with a writing partner and, as Gary described it, "talk about the things we were writing and making sure that things made sense." Gary explained:

> Usually [writing partners] are the best judges. They can see all kinds of mistakes and pick out better wording for you a lot better than you can because you're concentrating so much on the piece of writing that you're doing. The other person's a lot more critical because they're not in the same frame of mind that you're in.

The Non-collaborators

The three students (Alexis, James, and Robert) who tended not to collaborate on their writing with a writing partner nevertheless offered some insights into what would transpire when they occasionally did engage in such a strategy. James's remarks were fairly typical of what I was hearing from these students. He explained that he preferred working on his writing by himself, "unless there's really something I'm not sure of."

Recognizing that even these "non-collaborators" had engaged in some sort of collaborative activity in Grade 8, I asked them to describe their experience with collaborative writing. Alexis, who "sometimes, but not very often" has sought assistance from a writing partner, described that she would ask her reader what he saw or found. She added that rather than asking for suggestions to correct her writing, she was looking for "just kind of an opinion." James recalled an instance in which he and his writing partner exchanged first drafts of their work and they looked at such things as content and writing skills. Robert recalled that two or three times in Grade 8 he had shown his writing to another student. In such instances, he and his writing partner would exchange machines, read one another's text, offer suggestions for improvement, and make the changes directly onto each other's machine.

The Role of a Portable Word Processor in Collaboration

I explored how a portable word processor might be used in such collaborative endeavors as brainstorming and researching, responding to a draft, and proofreading.

Some of the informants (Dawn, Gary, Rita, Tyson) said that they collaborate early in their writing processes, especially when engaging in brainstorming. Concerning whether a portable word processor played an important role in such collaboration, Dawn's remarks were fairly typical of those voiced by these other students. Comparing collaborating on brainstorming using pen and paper with using a portable word processor, Dawn responded that collaborating on a piece which had been word processed was easier: "When you're having someone else give you ideas, they usually give you a whole bunch of ideas at once. If you're writing with pen and paper you might forget some of the idea, [but] if you have your WP-2, you can type them all out at once.... It's faster." When I added that working with the word processor might also mean that she could be making changes directly to her text, Dawn agreed that was another reason why it would be easier.

Mr. Ziff supported the students' contention that the early stages of one's writing were well suited for collaborative efforts: "It's at the organization and research stages, more so than at the writing stage [that] there is quite a bit of laptop passing back and forth." He added that a problem with this appraisal is that he does not see the actual completion of a writing assignment, and that using the machines to collaborate during other stages in their writing might be equally as effective. Echoing what Ms. Hansen had also told me about the limited amount of time available for her students to engage in in-class writing, Mr. Ziff stated that most of the writing which his students attempt is completed at home.

Mr. Duke also thought that an effective collaborative activity using the portable word processors would be in the area of gathering information. He commented: "In the interest of saving time, one person will research a certain area of a topic, and another will research another, and they'll combine their findings." However, he added that he usually does not encourage collaboration with the writing of essays: "Whenever I give a paper, I want to hear from the individual student. [For] some students who are very quiet, this is their only opportunity to give me an idea of their thought processes."

A few of the student key informants said that they collaborated a bit later in their writing process, such as when they had written a draft or their work. Elizabeth said that she mostly would be wanting feedback on the content and organization of her writing; she wanted to know whether her readers understood what she was trying to say. She stated, "If they don't, they tell me suggestions, or if they think it may sound better, it would keep them more interested, if it was put in a different order." Elizabeth also indicated on a

questionnaire that such collaboration would "make my piece more enjoyable and less confusing."

Ms. Hansen voiced some reservation as to how well students at this age level might collaborate about such things as content and clarity: "I haven't noticed too much, 'Can you help me with this.' [It's more] 'Look what I wrote.'" She suggested that such collaboration might be successful "if you have the right person[s] doing it." To illustrate, she described what she might observe "once in a while":

> [The student-reader might say,] "I don't understand this. What are you saying?" And he or she would make the other person restate it in some way. And [the writer] would say, "Well, that's what I meant." And the person who was asking the question would always say, "That's not what you said." The writer would [then] think about it.

A few of the informants suggested that they also collaborated towards the completion of their writing process by proofreading one another's texts. In describing this activity, Dawn's remarks were fairly typical. She said that she would most likely hand her portable word processor to her writing partner and have her scroll through the text. Dawn would ask her partner what changes she was proposing to make and then "she would probably type them out for me." Dawn agreed when I suggested to her that in this collaborative arrangement the writing partner was functioning mostly as an editor.

Dawn added that having a writing partner proofread her text for such things as content and mechanics was an important part of her writing process: "Sometimes, if it's my own writing, it's hard to notice mistakes." She added that she felt she was capable of reading her own work for ideas and support, "but it's better to have a writing partner to make sure."

Gary discounted the idea that collaboration frequently occurred near the completion of one's writing: "Usually [when] we're done writing them is the day we have to hand them in, and [then] it's usually too late. Usually we read each other's work on the same day that it's due, [but] by then it's too late to offer help because you usually can't get it printed out in time."

My own observation sessions led me to agree with Gary's assessment. While I did observe some students engaging in the type of collaboration described by Dawn, they were few in number; what proofreading I did see occur was usually a hasty reading of a writing partner's hardcopy followed by a quick application of correction fluid. The infrequency of employing the WP-2 as part of most students' general proofreading strategies may stem from a general lack of available time in the classroom for such activities.

The Role of Hardcopy in Collaboration

The student key informants said that they favoured working collaboratively from a text which had been word processed rather than from one which had been handwritten. Typical of their remarks was that voiced by Elizabeth: "It's easier to understand and to read than if somebody hand writes it. Lots of times I can't understand what the letter is.... With [wordprocessed text] it's not as choppy reading it because I don't have to figure out what that word is."

However, as I was interviewing students, I began noticing that several of them seemed to be speaking cautiously about how best to use the WP-2 in a collaborative activity. Typical of their remarks was that voiced by Rita: she stipulated that she had found that it was better if the writer had the machine in front of him or her with the collaborator sitting to the side. She commented, "You can have it on your desk, and you can say, 'Do you think this is a good sentence?' and they can say 'Oh, yes, that's good.'"

Such stipulations seemed to be affected by the design of the machine--in particular the manner in which its LCD screen rendered text. The students recognized that there could be a problem with collaborators both trying to read the LCD screen at the same time: while one student would be able to read the screen by positioning it directly in front of him or her, the other student, sitting at an angle to it, would have difficulties reading.

Elizabeth described the problem: "If you are at an angle, [the LCD screen] turns blue, so you can't even tell which part is letters or anything." On a questionnaire she offered a simple solution: the writing partners could respond to a hardcopy of the wordprocessed text, preferably double spaced to facilitate making revisions.

Rita also offered another consideration concerning whether she would hand to her writing partner her WP-2 or a hardcopy: it would depend on how well she had written her draft.

> It just depends on how many mistakes [are present]. If you have a whole bunch, the structure is all wrong and there are sentences that are not even in a good sequence, then I guess it would probably be easier to have a hardcopy because then [the collaborator] could draw arrows and underline.

She added that when she reads another student's writing, she prefers reading it on a hardcopy "because then I can see the whole thing and then I can point arrows and say, 'Well this sentence shouldn't be here. It should be your opening sentence.' You can [then] bring the arrow all the way up to the beginning paragraph." If she feels more confident about her writing, she does not print a hardcopy for her writing partner; instead, she will hand her WP-2 to her reader and ask that changes be entered directly into the machine.

Even some of those students who seldom engaged in collaborative writing strategies pointed to the necessity of making hardcopies for a writing partner to respond to. James suggested that, if he were to collaborate using his portable word processor, he might first make a hardcopy of his text and then work from that, "especially if it was a longer piece of writing." Robert felt that teachers might prefer working from a hardcopy of a student's work "so they could look it over more in depth [and] write on it." Further, Robert said that some of the few instances where he had collaborated had involved working from a hardcopy, and that, given a choice, he would prefer hardcopy over reading from the machine. He added that he found reading text on the screen of the WP-2 "limiting because I can't really see the whole thing." When asked if he would feel that a hardcopy would still be necessary if he were collaborating with a classmate in front of a tabletop computer, Robert replied that he would not need a hardcopy.

James too had said earlier that he had found the screen of the WP-2 to be too small for him to work satisfactorily with longer pieces of writing, and that he liked to be able to see more or all of his work at one time. When I asked him whether he thought that the LCD screen of such a machine was adequate for collaborative use, James replied, "It's adequate, but it's not as good as pen and paper." He added that collaborating in front of a tabletop computer with its larger screen "would be better," for it was "kind of difficult" for two students to read off the screen of the WP-2 together.

Mr. Cumulus shared the students' view that the design of the WP-2 seemed to limit effective collaboration: "I think that the limiting factor here is that that screen is so small, that if you want to do any collaborating visually you have to pretty well get in front of that person or grab the machine and have it in front of your face, and that's time-consuming." Echoing a view I had heard voiced by Mr. Ziff early in my study, Mr. Cumulus added that, from his own experience, viewing students' homework as rendered on the machine's LCD screen was frustrating:

> It is such a small, limited amount of homework you are looking at. You have to stop at each student and say, "Okay, move it up," and watch it scroll. So homework checks take a long time, whereas before I just had to glance over there and over there (motioning with his hand towards where students would usually be sitting) to see whether there had been an adequate effort.

The importance of hardcopy in student writing was emphasized by Elizabeth who contended that other students were working "mainly" from hardcopies of their writing when collaborating; however, Mr. Ziff disagreed, saying that he had observed few of his students collaborating over hardcopies of their work-in-process.

When I asked Ms. Hansen to describe the collaborative strategies she had noticed in which the students were engaging, she seemed to support Mr. Ziff's contention. Ms.

Hansen responded that she thought that most frequently the students were collaborating by passing their machines to one other or they were leaning over and reading from one another's screen rather than making a hardcopy of their text-in-process. While she had seen some students collaborating over a printed hardcopy of their writing, "most of the time I think that they would get up with their machines and go visiting."

My own observations were that, while I had watched several students collaborate during the very early stages of their writing process, particularly in the areas of brainstorming and sharing research, I had seen few students engage in collaboration later in their writing process when it might have been possible to print and work from a hardcopy. Part of the "problem," if I can call it that, I alluded to earlier: while I did observe that students frequently were being given class time to begin work on a writing task, very seldom were there opportunities in which time was being permitted for students to work in-class on later stages of their writing.

The Impact of a Portable Word Processor

The characteristic which most obviously distinguishes portable word processors from tabletop computers is their portability. The technology accompanies the student into the various classrooms and is immediately accessible. Further, the use of the technology is largely determined by the user who employs it whenever he or she deems it to be beneficial.

To inquire as to how such a technology impacted on how teachers in the two classes were teaching, I posed the question: **What sort of impact has the presence of the WP-2 had on the teaching/learning situation in the classrooms at St. Ethos school?** This research question inquired into the extent to which portable word processing affected changes in the writing strategies of students and the teaching strategies of teachers. To answer this question, I sought information from the teacher-participants.

The Impact on Teaching Strategies and Curriculum

The Difficulty of Assessing Impact

Mr. Duke and Mr. Cumulus offered responses to the research question. Mr. Duke commented that there seemed to be little noticeable effort on the part of teachers to change their teaching strategies when working with the two classes which had purchased the WP-2s, and provided an interesting reason why. "If the impression gets out that teachers are changing their teaching focus to accommodate and accompany these machines," he said, "then the parents of the other two classes are going to ask [questions]." Consequently, in

order for there to be more evenness between the different classrooms of students, Mr. Duke "consciously tried to stay away" from teaching differently. "Plus," he added, "the jury was still out [as to] what kind of benefits [a portable word processor] would have."

Mr. Cumulus offered a similar assessment, saying that he did not think it was right that, because the students are using this particular machine, "teachers should be changing their teaching to fit the tool." However, he did suggest that the introduction of a portable word processor into the grade eight classroom did make one stop and ask, "I wonder if this tool now makes certain things more possible or makes the student more inclined to be wanting to do certain things [with writing]." Speaking from his own experience, Mr. Cumulus had observed that his students seemed able to write faster, their hands did not get as tired, their writing looked neater, and they tended to be a little more proud of what they had created. He added, "All these attitudinal shifts I can capitalize on."

When I asked Mr. Duke whether he thought the presence of portable word processors had affected students' attitudes towards writing at all, he responded: "The novelty of the technology has sort of elevated the importance about their writing.... The immediacy along with the objectivity of their writing is probably one thing that's survived the other novelty aspects of it that [wore off] after a few months."

In-class or Take-home Writing?

Several of the teachers interviewed mentioned that there was at least one change in their teaching strategies influenced by student use of the Tandy WP-2s. Most teachers recognized that more time was needed for those students who were writing with the word processors, at least until the students had gained a greater degree of proficiency with keyboarding. However, a continued expectation on the part of the teacher-participants was that students complete most of their assigned writing outside of the classroom. Most of the teachers, like Mr. Duke, gave the students one or two classes to work on a particular writing task and provided some assistance and instruction during those periods, but did not provide time during class specifically for collaborative revision or peer editing.

Ms. Hansen spoke on this issue as she reflected on the year's experience and considered what things she might have liked to have done differently:

> I would have changed my program to concentrate more on writing than trying to do the literature and everything else sort of equally. I would have skewed it more to writing, and spent more time on their producing compositions for me, and therefore they would have been a bit more comfortable with doing peer editing and revising.

The Computer Curriculum

The presence of the WP-2 also seemed to have some lasting impact on parts of the computer courses at St. Ethos. While the overall sequence of skills and concepts throughout grades seven through nine remained much the same, Ms. Norris was finding

that there was less pressure on her grades eight and nine programs to provide time for students to access the machines for their writing needs in other courses. Previously the only way in which a student might have been able to access a machine and word process some writing for another course might have been to finish his work for the computer course first and use whatever time remained in the class period for such writing. Such a need changed, however, with two complete grade eight classes at St. Ethos having immediate access to their own word processors. With less demand from students for access to the tabletop computers to complete writing assignments, Ms. Norris felt there was more time available to cover the computer curriculum more effectively.

The Classroom Workspace

The presence of portable word processors had prompted Ms. Hansen to try a different form of seating arrangement in her language arts classes. While she prefers a "horseshoe" configuration for language arts, to use the machines effectively she experimented with seating students in groups of six with their desks in a small circle. Such groups permitted students to pair up and assist one another, either by sitting across the way from one another or beside each other. Other seating configurations such as simple pairing could also be created with the goal of encouraging collaborative behaviors. Ms. Hansen added that such a configuration reflected her belief that language learning is a cooperative enterprise rather than an individual one.

However, such a seating arrangement also created at least one problem. Ms. Hansen found that increased socializing by one of her classes prompted her to change the seating to a more traditional form: "I reverted to rows basically because of the lack of discipline of the kids." In this way she saw that the portable nature of portable word processors could be a bit of a drawback compared with the more isolative nature of tabletop computers: "Usually tabletops [are] arranged differently, [and so] I think the students would concentrate more on what they were doing. Kids with their laptops are still very accessible to each other, so they can put them aside and just do their socializing." Ms. Hansen added that she found the circular seating configuration made it difficult for her get around to see all the students and what they were doing, saying that if students were sitting side-by-side as they would be in a computer lab they might possibly be more on-task.

Printer accessibility.

As suggested earlier, there was an interesting difference of opinion between students and teachers concerning the role of printers in the writing processes of students using portable word processors. Seen from the perspective of the student who is writing with such a tool, the need to use a printer may occur at almost any point along the writing process spectrum, whether it be to create a hardcopy of a student's brainstorming for the

purpose of organizing one's ideas or to print a revised draft for the purpose of being proofread by a classmate.

Printer accessibility was particularly important to the successful use of hardcopy in collaborative writing. Comments such as those voiced by Elizabeth made it very obvious that for some students accessibility to a printer was a necessity. When asked how often one might see her taking her WP-2 and handing it to a writing partner, Elizabeth responded, "Never, unless I can't get a printer." Pursuing this further, I asked Elizabeth if access to a printer was very important to her when it came to collaborating, to which she responded that it was.

The problem of printer accessibility was impressed upon me by one student who disclosed that although he did not have a computer at home, he had a printer. When I asked why that was, he responded: "Because you are only allowed to print during lunch, morning, or after school. [Printing then] is too much trouble With a printer at home I can print any time I want."

Other support hardware.

Not all of the students who purchased Tandy WP-2s were able to utilize the machine for their writing continuously. Regardless of how well they had been instructed on the importance of bringing to class an extra set of four charged nicad batteries, it was my observation that on any given day several students would experience problems with batteries becoming depleted of power and not having a fully-charged set with them. As the day progressed, the numbers of students experiencing such problems would increase until about 30% of the students were no longer able to use their machines. Such a situation would effectively remove the portable word processor as a writing tool for these students. Compounding things was the general fragile nature of the word processor itself. During my nine weeks at St. Ethos, I knew of four students whose machines were being repaired.

While these re-occurring problems might prompt one to suggest that students need to be better organized and more careful, I contend that, as Ms. Hansen alluded to several times, "it's the nature of these students" that they are at times forgetful, disorganized and inadvertently careless. If one accepts that as a given, then one might also ask what can be done to lessen the impact of such occurrences on students' writing experiences. An answer might be found by looking at the situation at St. Cosmos School.

As is the case with St. Ethos School, several students at St. Cosmos had purchased their own machines. However, owing to its size St. Cosmos had also been able to purchase a class set of WP-2s and corresponding sets of nicad batteries. Although the intent was to make available WP-2s for those students who had not purchased such a

machine, any grade eight student could borrow one. Sets of batteries were kept fully charged and made available to students on an exchange basis.

The Impact on Student Attitudes

Appreciating the Need to Revise One's Work

In spite of how easily revisions might be made with a word processor, it was the observation of several of the teacher-participants that the majority of the students in the two grade eight classes seldom attempted to revise their writing. Typical of their remarks were those offered by Ms. Hansen. She suggested that for most of the students some sort of teacher instruction was necessary to encourage revision: "Most of them though, if I insisted, would go back and revise. They would work with a partner, and they would get each other's ideas." However, Ms. Hansen noted, "It is not something that came naturally," adding that the attitude of some of these students appeared to be one of "It's my work and I'd rather not change it."

Valuing Feedback from One's Peers

As many of the student key informants described collaborative situations in which other classmates were making suggestions as to how they might make changes to their compositions, I wondered about what these students' attitudes were towards hearing such feedback and making such changes to their writing. I recognized that some students, when they have written something, may think "This is mine and it's wonderful," and they may spurn any suggestion of making revisions, and that there are others who think "I've worked so hard just simply writing this out, I don't want to do anything more with it."

When I asked Ms. Hansen, the language arts teacher, whether she had observed any of her grade eight students demonstrating such behaviors, she answered that she had. In describing how willing a "typical" grade eight student is to make revisions to his or her own writing, Ms. Hansen remarked: "The typical [attitude] is 'I've done it. I don't want to change it.'" She added, "There are some of course who come for help and ask, 'Is this okay? Can you help me with that?'"

While such data concerning how students were responding to feedback from writing partners about their writing were important to my study, it was more important to learn whether a portable word processor had any effect on their attitudes towards such feedback. To elicit this data, I asked informants to envision two different situations, one involving receiving feedback to writing which had been handwritten and the other involving receiving feedback to text which had been word processed. Six of the student key informants presented their reflections concerning this issue.

Rita imagined having a classmate or a teacher read over a handwritten draft of her writing and point out to her some ways in which it could be improved. She commented that, if it were a good copy of a draft, she probably would respond negatively to such feedback: "I'd think that this is the best that I can make my paper, and then people, if they go and say, "This is wrong and this is wrong,' then I'll think, 'Oh, great! Now I have to go and fix it.'"

When I asked Rita what her attitude might be to the other situation, one in which she would receive feedback to text which had been word processed, she replied that her response would be different: "If they say, 'This has to be fixed,' [or] 'This is wrong," I can just type in the revisions and then reprint it." Asked whether she would say that, by writing on a word processor, she might view the prospect of making changes to her writing more positively, Rita replied, "Yes, because I could fix it then."

Going one step further, I asked Rita whether it would be accurate to say that, because the changes are so easy to do using a portable word processor, she might be more inclined now to seek feedback. Rita replied:

> Yes, that's what I usually do. With my poetry and my [other] writing, I usually show [it] to my friends, and I'd say, "Read this over. Does this make sense? Is this right?" And then I usually read theirs over.... Or sometimes it won't be printed out, and my friends will just give me their laptops and I'll read it over, and I'll just fix it for them on their laptops.

Elizabeth too said that, in such a situation where her text had been word processed, she would consider suggestions for revision favourably: "I would probably try [the revisions], because I'm not too lazy to do that anymore in case it takes me longer." When asked what her attitude would be if someone came along and read it and offered suggestions on how to revise a final draft which she had written by hand, Elizabeth responded, "I'd probably not take any of them into consideration because I don't want to have to write it out again."

Of all the student key informants, Gary was the most positive about receiving feedback from a writing partner about his writing. He said it would be "no problem at all" to consider those changes to his text which might be suggested by a reader: "I love it whenever someone tells me that something is wrong, because it's so easy to change. Whenever you have it on the WP-2, all you have to do is print the whole thing out again, and that'll take about thirty seconds, [rather than] writing the whole thing out again." Gary suggested, however, that this positive attitude had not always been there:

> Before, I would have a final [handwritten] copy and I'd be so proud of it. I'd bring it downstairs, and I'd show it to my mom, and she'd say, "Everything's great, except this one word should probably be changed." And I'd say, "Aw, great! I have to write the whole thing over again!"

When asked to describe how he felt about such feedback, previous to being able to write on a word processor, Gary responded "frustrated."

The three students who seldom engaged in collaborative strategies when doing their writing (Alexis, James, and Robert) also offered their impressions about whether working with a word processor had affected their attitudes towards receiving feedback from a writing partner. Fairly typical of their remarks were those voiced by Alexis, who agreed that it would be fair to say that she was more willing to listen to such evaluative comments from a writing partner if her writing had been done on a word processor. However, given a situation in which she received feedback to a piece which had been handwritten, Alexis said that her response to such feedback "would be different because you would say 'Aaagh! I don't want to go back and change this and write it out because it took a long time.'" Correcting handwritten text "is just more of a chore." When asked, Alexis agreed that she would be more reluctant to consider such advice and more anxious about the suggestions which might be offered to her. She added that revising and editing one's work is "always a drag," but it would be "even more so" if one were not writing with a word processor.

While almost all the student key informants spoke very positively about receiving feedback to their work, one student responded negatively. James said that he seldom collaborated on his writing: when he had sought out a reader's response, it was only to work which he had written by hand. Speaking to that situation, he said: "Unless it was really important, I wouldn't bother [making changes to my writing]. [When writing with pen] you would have to rewrite everything out all over again." When I asked whether his attitude might not change if he attempted to seek feedback on some writing he had been doing on his WP-2, James reflected for a moment and then replied more positively: "I'd definitely consider it more because it's not as much of a hassle to change [things] on the laptop."

Integrating a Portable Word Processor Effectively

As stated in the introduction to this chapter, my final research question asks: **What factors contribute to effective use of portable word processing, and what do we need to provide in the core subject classrooms to assist students in using the technology?**

While I recognize that the question is two-pronged, I also recognize the causal relationship between these two parts. This causal relationship prompted me to weave the data elicited by both parts of the question, to integrate the data.

Understanding the Machine's Limits

The Students

In the course of asking Ms. Hansen for her views on whether having a portable word processor has benefitted the students in her two language arts classes, I learned about the importance of having students understand what sorts of things the technology can and cannot do to assist one in the act of writing. Ms. Hansen found that a portable word processor has helped those students to write better who had "the right attitude," who understood 'This machine will help me be a better writer, [but] it will not be the writer for me.' She added that even those who assumed that the machine would automatically do things for them have benefitted from having the machines, but the benefits have not as great as for the other students.

The Teachers

All of the teacher participants seemed to understand that the WP-2 was not a panacea for whatever problems students were having with their writing. At the same time, they recognized it as a writing tool which might facilitate student writing.

Orientating Participants to the Technology

Orientating Students

Ms. Hansen, the language arts teacher, had helped implement the use of portable word processing during the last school year. Her task had been to familiarize her students with the various functions of the Tandy WP-2 and to teach them how to use it as an effective tool for writing. She questioned whether her role should be continued the next school year, saying that she would like to see such a role handled by someone other than just the language arts teacher: "I'd like to see someone else teach them the cut and paste and the functions of the keys.... We spent almost a month [on] just "meat and potatoes" before they could really start writing." While the students were adept at keyboarding, a skill which many of them had learned in Elementary school and some had learned in Grade 7, most of the students were gradually learning to perform the various functions of the machine. When I said that it sounded as if the time spent on orientating the students to the machine was time taken away from the rest of her already-crowded curriculum, Ms. Hansen agreed.

Orientating Teachers

As described in the third chapter, teachers were orientated to the technology primarily by means of a visit to St. Cosmos School and a two-hour inservice held after school. As well, Tandy WP-2s were loaned to the school so that the staff could try out the machines. When I interviewed the teacher participants individually, I asked each for their

opinions concerning how well they had been orientated to the technology. All expressed satisfaction with the process and with their level of understanding the workings of the Tandy WP-2.

Interestingly, some of the non-language arts teachers suggested in their responses to my various queries that they were receptive to learning more about the nature of writing and how a portable word processor might make such writing better. Mr. Duke seemed particularly introspective and interested in learning more about how the tool could be utilized. However, not all expressed such interest: Mr. Paul saw few opportunities for writing in his Math 8 course, and viewed the WP-2 as a tool offering limited use.

Issues and Assessments

Issues

In the course of my gathering and analysing data during the case study, there surfaced a number of issues:

- Can Using a Spelling Checker Make One a Better Speller?
- Was Diction a Concern for These Grade 8 Students?
- Does Using a Word Processor Create a Halo Effect?
- Collaboration Using the WP-2: Is It a Product of Portability or Availability?

While these questions undoubtedly concern other types of word processors and computers as well, I examine them through the experiences of students and teachers engaged in using portable word processors.

Can Using a Spelling Checker Make One a Better Speller?

Besides wanting to know how the students were using the WP-2's built-in spelling checker, I wondered whether such a feature was helping students become better spellers. I first approached the teachers about this question.

Mr. Ziff observed, "I have a lot more spelling errors with the students who do not have the laptops." While such an observation seemed to be speaking positively about the effect of a spelling checker on the written product, I felt that the question remained as to whether the students themselves were experiencing any benefit in using a spelling checker on a day-today basis.

On the same questionnaire in which I had asked about their use (when and how) of a spelling checker, I asked students in both classes "Has it helped you become a better speller?" Six of the eight student key informants were strongly convinced that the technology had helped them in this regard.

Four of the students felt that having a machine which alerted them to which words they were having difficulties spelling correctly helped them learn how to spell those words. Typical of their responses were those voiced by Robert and Rita. For Robert, the key to becoming a better speller was recognizing which words he was misspelling: "[The WP-2] helped me realize the mistakes I've always been making in the past." Rita felt that seeing both the error and its correct spelling were helpful: "I think it has helped my spelling because it highlights the word I misspelt [and] I remember it.... If you see the word and you see [how] it [is] spelt, then you'll know the next time... how to spell it."

The other two key informants, James and Gary, added something further in their responses to the question. While James responded similar to Rita that he valued being able to "more often see the correct spelling of words," he also thought that the WP-2 provided a handier means of correcting his spelling errors: "Normally I might not go look up a word, but here it is much easier." Gary seemed to go one step further in his appraisal when he commented: "When you have the spell check, you are not afraid to try using new words. This is because the dictionary is right in front of you."

Only one student, Alexis, thought the technology was rather counterproductive: "...it fixes my mistakes for me, and I don't really pay attention when they're being corrected, so most of the mistakes are there when I write things out.... For me, unless I fix the mistake, I don't remember the correction."

Was Diction a Concern for These Grade 8 Students?

In learning how the grade eight students at St. Ethos School were revising and editing their texts, I began wondering whether in their writing processes there was a concern about effective word choice. I also began wondering whether they were utilizing the built-in thesaurus. Of the four key informants who offered remarks concerning word choice, only two (Rita and Gary) suggested that the WP-2 played an important role.

Rita mentioned that she uses "better" words, and attributes this to the presence of a thesaurus built into her word processor. She mentioned that she would use her thesaurus so she can look up a word and find "another way of saying the word instead of using the same word all the time." She also said that she uses her thesaurus to help her find the word she wants as she is composing.

Gary mentioned as well that he revises his work by reading it over and "replacing words with better ones." At times he substitutes these "better" words for others which he finds he has been using too frequently. Another factor in Gary's attention to diction might be his belief that the use of better words "impresses the teachers more."

From hearing such responses, I began to feel there was some degree of concern on the part of these grade eight students regarding choosing a word which meant precisely

what one wanted to say, but that such concern was fairly limited. I asked three of the teachers (Ms. Hansen, Mr. Cumulus, and Mr. Duke) for their observations.

When I spoke with Ms. Hansen, she agreed with my assessment. Her observation had been that, rather than involving changes to diction, most revisions involved changes to ideas and sentence structure.

I mentioned to Mr. Duke that some of his grade eight social studies students had told me that they are intentionally using the built-in thesaurus to help them with word choice, and I asked him for his observations. He responded that effective word choice was not something about which he had an immediate assessment, saying "It's nothing I can say with any accuracy or confidence." I then asked him specifically if he could say whether the diction of those students using WP-2s had been any more precise. He responded: "I can't say. With that question in mind, I'll be more conscious of this. In all honesty I can't say that it's stood out on its own."

Does Using a Word Processor Create a Halo Effect?

Pursuing the topic of revision and editing further, I also wanted to explore whether the word processor's capacity to render text as print benefitted or beguiled the student when it came to his or her contemplating revising or correcting a piece of writing. On one hand I recognized that a word processor could facilitate changes because it makes them so easy to complete; however, I also recognized that, because of its nature to render any text composed on it as legible print, either onto a monitor or as hardcopy, it could make any text look good, make it seem well-written.

Ms. Hansen responded to the possibility of the word processor producing such a "halo effect" by saying that such might be part of the problem but not all of it: "It's just the nature of the child. They just want to get it done so they can move on to something else. The impression I got most often was, 'I've got to hurry. I've got to get this done. I have to go.' They always had something else on their minds."

When I pursued the possibility of there being a "halo effect," it gradually dawned on Ms. Hansen that some students might indeed be misled by the apparently good appearance of the text: "No. But it's possible, I can see that. Actually it is true, because a couple of them did come to me and say, 'Look at this. Isn't this nice?'"

I spoke with Mr. Duke about the possibility of the machine creating a "halo effect" for students when assessing their writing. He had suggested to me earlier in an interview that a word processor might on one hand objectify a person's writing, and I later suggested to him this other possibility, saying that "for some students, when they word process their writing, it <u>looks</u> good...." "...so it must be [good]," he said, completing my remark.

Recognizing that he understood what I was suggesting, I asked Mr. Duke whether there might be a "halo effect" with using the WP-2. He responded:

> Yes, I think so. I'm just thinking about some of the... maybe some of the evidence at the beginning, when the classes first got their laptops... I sort of felt that the two classes who didn't have it sort of were envious, because everything these kids [with laptops] were turning out, even basic notes, had this sort of professional look to it... I would think that if the students who didn't have [laptops] felt that way, then it would be an easy assumption to make that the students who did have them also felt that way about their own work.
> There was one incident the second day of class where I'd given an assignment, and the [class without WP-2s] had gotten the assignment as well.... I started talking about good copies and things like that, and someone mentioned, "Well, they [the two classes with WP-2s] have their good copies right away." [The student was thinking that] as soon as they do it it's a good copy because they're typing it out.

I asked whether the student was interpreting "good" as being something which looks good, and Mr. Duke replied: "Yes, that's the thing. A good copy means, your writing is suddenly within the lines and how everything is more professional looking."

Collaboration Using the WP-2: Is It a Product of Portability or Availability?

When the students were discussing how they collaborated in their writing, it also seemed increasingly apparent that an important characteristic of the WP-2 which favoured its use in such activities was its portability. When asked to compare collaboration which involved using a portable word processor with that which involved using a tabletop computer, several of the informants immediately responded that they favoured using their WP-2s. Typical of their responses were the remarks of Rita and Dawn. Rita commented: "It's easier to collaborate with the WP-2 because you can move it. Say you're in a classroom and your friend is sitting across the room. You can pick up your laptop, go over, and show it to them. Dawn remarked: "It's easier [with the WP-2] because the tabletop computer isn't portable.... If you were collaborating, you'd have to bring someone with you into the computer room."

However, at this point I began wondering whether the effectiveness of a portable word processor in collaborative writing was not so much owing to the portability of the machines as it was to the availability afforded by each student having his or her own machines. When I suggested to several of these students a scenario in which their language arts class were doing their writing in the computer lab using the Apple IIe computers available there, their earlier remarks seemed to do a complete about-face. For example, Dawn responded, "It might be a little easier on the tabletop because you can see everything at once." She agreed that in a computer lab the two writing partners could sit and view the screen together. Elizabeth too voiced the opinion that reading text from a tabletop computer would be easier for those students engaging in collaborative writing: "It's bigger and you

can just look at it from [a greater angle]. You can sit a little off to the side. It's much easier to see. It's standing upright." She added that the screen of a tabletop computer is "big enough" to reduce the necessity of having to print a hardcopy.

Respondents Assessments of Writing with a Portable Word Processor

To close this chapter, I present the data prompted by two questions which arose early in the study. My feeling is that these questions are relevant to any examination of the worth of using a portable word processor for student writing.

Does the WP-2 Make Writing Easier?

In a questionnaire given to all students in both classes using the Tandy WP-2 Portable Word Processor (see Appendix 2), I asked students to respond to this statement: **"Do you find that the Tandy WP-2 makes writing easier?"** Students were asked to respond "Yes," "No," or "Sometimes," and to discuss reasons for their response.

"Yes."

All eight key informants offered responses, five of the students answering "Yes."

Three students commented about the speed with which they could keyboard. Elizabeth's statement represented the views of Dawn and James as well: she thought the WP-2 is "much faster than handwriting."

Three students remarked about the built-in spelling checker. Elizabeth felt that having such a feature means one doesn't have to look up words in a dictionary. Dawn commented that the spelling was "more accurate." To James, having a built-in spelling checker "makes proofreading easier."

Three students remarked that using the WP-2 seemed to eliminate "writer's cramp." Typical of their remarks were those voiced by Rita who said that her hands never seem to grow tired or weak from typing.

Two further remarks offered by the students supported that the WP-2 make writing "easier." In casting her "Yes" vote, Rita said that her ideas "seem to flow better" and she can think of "better ideas." Dawn offered an additional remark about the machine's built-in thesaurus, saying it made searching for synonyms easier.

A further comment by James suggested that the WP-2 made writing easier because it presented text neatly. Echoing Gary and Dawn's remarks presented earlier, he said: "Well, it definitely makes it a lot neater and more pleasing. Sometimes handwriting can be a little confusing."

"Sometimes."

Two key informants responded "Sometimes" to the question of whether the WP-2 makes writing easier. Gary stated that while cutting, pasting, and adding lines are "a great

advantage" in that such functions "save a lot of time," he thought that, at times, he types so fast that he gets ahead of himself. Alexis offered a similar response, saying "It makes it almost easier because you don't have to go through so many things until you finally come up with your [polished] draft, because you don't have to be rewriting and rearranging for hours--you just do it in a much shorter period of time."

"No."

Robert was the only key informant to respond "No" to the question, saying "It makes the work go faster, but not easier."

Does the WP-2 Make Writing Better?

In a questionnaire given to all students in both classes using the Tandy WP-2 portable word processor (see Appendix 2), I asked students to respond to this statement: **"Using a portable word processor has helped me WRITE better."** Students could offer one of five responses ranging from "Strongly Agree" to "Strongly Disagree" with a provision for a "Neutral" response.

In addition to their responses on the questionnaire, seven of the eight student key informants offered reasons for their responses in the context of an interview.

"Strongly Agree."

In discussing her response, Elizabeth suggested that the WP-2 counteracted a tendency of hers which she described as being "lazy." Without such a machine, she would be reluctant to complete a revised draft of her writing. She commented that, in such a situation, "I don't do such a good job. I don't make it as long. I don't fill out my thoughts as much as I would with the word processor."

For Rita, a portable word processor definitely makes her writing better: "I know my writing is... going to be the best I can make it now. It's going to be neat, it's going to be correct, it's going to have better words--it's just going to be perfect now, practically." She added that the WP-2 helps her with her prewriting as well: not only is her brainstorming "neater," she can "plan better on it.... It's easier to sequence it." I asked Rita if she meant that the WP-2 improves her writing's coherence, and she replied "I think so."

When I asked her further about whether the machine affected the completeness of her ideas, she answered "Yes, that's easier too, because if I print out my hardcopy then I can just write it down, what I want to add, and I can just add it into [the WP-2]." She added that she felt that her writing was longer because of the WP-2: "Instead of just putting it down and not explaining what I mean because I don't want to write it out so much anymore," she is able to provide more support in her writing.

"Agree."

Four student key informants responded "Agree," with three offering quite different explanations concerning their choice.

Tyson supported his response by saying: "It helps me write better because it helps with spelling a lot with the spell checker, and I guess sentence structure." He added, "When I'm reading it over on the WP-2, it's easier to understand than on paper because my [hand]writing isn't that neat." When I asked if he was saying that he could see his text better, he agreed.

James's comment suggested to me that the machine had effected a shift in attitude towards making revisions: "It helps you revise... and correct a lot easier, and because it's easier you're more likely to do it. That makes your writing better."

Gary initially responded "Agree" on the questionnaire, saying that it had helped him "get all my ideas down quicker." However, when we discussed his answer he said, "I don't know... I might even answer that question different now. I wouldn't say it made me a better writer. I don't think I'm any better, I just think I'm more efficient. I don't think a machine can make you a better writer."

"Neutral."

One key informant, Robert, offered a "Neutral" response. When asked for his reasons for responding in this manner, Robert responded: "I don't know.... I find that the quality of my work is practically the same [compared with writing with a pen]."

Disagree."

The remaining key informant, Alexis, responded "Disagree." She commented that such things as editing were easier using a portable word processor, but the quality of the writing which this tool facilitates "remains the same." She added that the WP-2 "doesn't make the quality of the writing better because that depends on the individual person."

Teachers' Responses.

When I asked some teachers whether students in the two classes using the WP-2 were writing better than the students in the other two grade eight classes, they hesitated to offer a conclusive response.

I asked Mr. Duke for his observations about students' correct use of writing conventions such as spelling, punctuation, and grammar. Reflecting on the writing from his two grade eight social studies classes, he said that the writing from the class using the WP-2s was better, but he was hesitant to single out why: "I'm not sure if it's because there are better students in the [class using WP-2s] or if it's because of the laptops."

Similarly, I asked Mr. Cumulus for his observations comparing the writing of his grade eight science students using the WP-2s and those using pen and paper, naming

specifically such areas of writing as content, organization, style and writing conventions. He too responded cautiously:

> Hmmm... I think there are other variables here that we should consider before we make any kind of statement on those areas, and that is... the general academic [ability] of the two classes that have the word processors is significantly higher than the two that do not have the word processor. So, generally speaking, the idea of all the different aspects of writing, I think you'd have to say, "Definitely, yes." But then again is it the product of the WP-2 or is it the product of a better quality student? I think it would have something to do with the quality of the student.

A Word About the Final Chapter

The above comments offered by Mr. Duke and Mr. Cumulus serve as an appropriate means of introducing the final chapter of this study. In Chapter 5, the findings, conclusions, implications for teaching and suggestions for further research are all the product of the investigator having examined a phenomenon through the lens of exploratory research, and, in keeping with the nature of case study, all interpretations and generalizations must be made with care. As English language arts teachers and authors know all too well, when one writes there are many variables at work, and observing young writers experiencing a new tool and, for some, a new manner of writing, further complicates things. Nonetheless, within the conditions articulated in the study's Limitations and Delimitations, the final chapter offers what I hope are meaningful insights and directions for future inquiry into the phenomenon.

CHAPTER 5
FINDINGS, CONCLUSIONS, IMPLICATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Introduction

While it is customary in a final chapter to reintroduce the research questions and provide findings and conclusions as "answers" for each followed by a section discussing implications and suggestions for future research, I have chosen to present the findings, conclusions, implications and recommendations in a series of themes which are more harmonious with the organizational pattern I have used in chapters two and four. Although this means of presentation tends to compartmentalize what may be essentially interrelated and overlapping aspects of writing with a portable word processor, I feel it is an effective means by which to strengthen coherence and aid understanding.

Each theme explores:

What the literature tells us. I summarize what previous research has observed and concluded about a particular aspect of student use of tabletop and portable word processors. The intent of such a survey is to provide a context, an opportunity to see how present findings relate to previous research.

What I have seen and **what I think of it**. Based on the data presented in the previous chapter, I present my findings and conclusions.

What it means for teachers. Such findings and conclusions suggest certain implications for teaching and learning.

What I recommend that we find out further. While the study seeks to answer many questions, it answers some only partially and raises others which suggest possible directions for future research.

The Findings, Conclusions, Implications and Recommendations

The Effect of a Portable Word Processor on Writing Processes

The Effect on Brainstorming, Mind Mapping and Researching

Brainstorming.

My review of the research convinces me that comparatively little research has examined the pre-writing stage of the writing process using a word processor. That which has been done tends to view using a word processor for brainstorming with some favour:

the technology lends itself to the listing of ideas, especially if the word-processing program has a "windowing" feature.

The data gathered from both my observations in the field and from the interview sessions suggest that a factor in whether a student uses a portable word processor for brainstorming is the degree to which he or she feels comfortable engaging in keyboarding. A student who is not proficient at keyboarding may find using the technology distracting: the act of consciously thinking about the mechanics involved in keyboarding may interfere with the flow of ideas.

Those students who are already proficient with keyboarding find that they are able to keep up with the flow of ideas better than they might have been able to using pencil and paper. Those whose proficiency is below par might try a variation on the strategy described by Elbow (1973) and Doyle (1988), a technique which is also described in a textbook used in grade eight, Perspectives in Writing: Two (Hannan, Hannan, Quigley and Wintrob, 1991): "If you are [writing], darken the monitor screen so that you can write without being tempted to revise or edit.... This computer strategy, called blindwriting, takes some practice to get used to, but it deepens your concentration" (p. 144). Having heard many students voice a concern about being unable to concentrate on their brainstorming or composing because of their weak keyboarding skills, my opinion is that such a strategy might help diminish students' concerns about such things as formatting and correctness of keyboarding and writing, and allow them to focus instead on their ideas.

While encouraging the less-proficient student to keyboard his brainstorming is certainly in keeping with both the belief that skill improves with practice and the philosophy of utilizing the technology more fully, I would like to know further whether such a strategy is beneficial to idea generating. Do we have to encourage the use of the machine for all the activities in process writing? I would also like to learn from students whether adapting the blindwriting technique for brainstorming is effective.

Mind mapping.

The research tells us that the more complex brainstorming format known as mind mapping is an effective means of collecting ideas; however there appears to be little research published to date which explores whether a word processor assists or inhibits the completion of this task. Blankenbaker and Hamstra (1989) suggested that such an idea-gathering strategy would be better attempted by a tool other than a word processor.

My finding is that the students in my study overwhelmingly rejected using their portable word processors to assist in the construction of thought webs. Several of them told me that earlier in the school year they had attempted using their machines to make thought webs, but the experience for them had been a very frustrating one and they had

long since abandoned using the WP-2 for such a purpose. Instead, the students found the act of constructing circles and ovals and of joining related ideas with an assortment of lines was performed much more easily with pencil and paper.

For even those few students who engaged in the creation of thought webs by using their portable word processors, pencil and paper still played a crucial role. Typically, these students would brainstorm on their WP-2s, then print a hardcopy of the ideas which they had listed, and finally work the material into a thought web by means of pencil and paper.

From such data and considering that a crucial factor in generating ideas is one's comfort level, I conclude that to create such complex constructs it may be more appropriate to use pencil and paper. Students also noted that constructing any type of brainstorming using pencil and paper resulted in one having a hardcopy immediately.

What this suggests for classroom instruction is that teachers should recognize that there are indeed limits to word-processing technology and that certain steps in writing processes may well be attempted better through the use of pencil and paper. Once again, it would appear that allowing students the freedom to choose which writing tool to use for a particular task is paramount. As Postman (1992) points out, "It is important to remind ourselves of how many thngs are quite possible to do without the use of computers" (p. 120).

It would seem there is a sizeable "gap" in the research concerning which things may be better attempted without the use of a word processor, and this area of mind mapping/clustering/thought webbing is certainly one which could be explored more fully.

Recording library research.

The only feasible type of computer which can be taken by the student into a school library is one which is portable, such as the Tandy WP-2. There have been very few studies published to date which explore the use of portable word processors, and to my knowledge none have focused on this particular aspect of writing.

The data gathered by my study suggest that the portability of the machine in terms of assisting in the gathering of data outside of the classroom is under-utilized. During my study at St. Ethos, I observed two or three class periods during which students went into the library to gather information for an assignment; however, during those periods I observed very few instances where students were using their machines for this purpose. Student and teacher comments during formal interview sessions confirmed that few students during the school year had utilized the portability of their machines in this manner. For many of the students, the preferred tool to assist in the gathering of resource data appeared to be pencil and paper. As with their observations concerning brainstorming,

most of the students saw little benefit in utilizing a portable word processor at this stage of their writing.

I cannot offer any reason why the students in this study were not utilizing the machine's portability more fully. Are students reluctant to use the technology for the gathering of data because they do not see its benefit, or do they not see a benefit because they have not attempted to use the technology for such a purpose? I also wonder whether, if more students did attempt to employ their machines at this stage, they might recognize both the amount of time which could be saved in being able to work with data recorded onto a portable word processor and the worth of having a machine whose portability allows it to be taken into a library.

Perhaps those students who are new to using the technology need to be shown by their teachers in the core subject areas what a portable word processor can do. This may result in students being able to make better choices as to when and how to utilize such a tool. For instance, by being made more familiar with what might by done with data once it has been recorded onto their WP-2s and more aware of the advantages of having done this, the students might be more inclined to utilize their machines.

Further research might reveal whether a correlation exists between the degree to which students do and do not understand about writing and about the ways in which they can use their portable word processor. Researchers may wish to examine more closely than did my study the extent to which teachers seem to allow for and capitalize on the presence of a portable word processor in their classrooms.

Planning, Organizing and Outlining with a Portable Word Processor

Did the technology help students plan and organize their writing?

Most of the studies have concluded that the word processor impacts negatively on the total planning demonstrated in computer-generated text: both initial planning and planning completed later in students' writing processes are reduced when writing is attempted with a word processor. Liechty (1989) maintained that the classroom teacher may be instrumental in providing necessary instruction to overcome the "erosion" of preplanning, organization, and focus which wordprocessed texts frequently demonstrate.

My study revealed that most of the student participants believed that the WP-2 portable word processor encouraged them to organize their work. While some students totally dismissed the idea of using the WP-2 to help them plan their work, others found a way to use the machine: one student said that he would not use the machine initially to assist with planning his writing because of the limited amount of text which could be displayed on the machine's screen, but a second student who had also noted the screen's limitations found that she could organize her ideas effectively once they had been printed

out onto a hardcopy. She could then plan her writing more easily by working from the "bigger picture" afforded by a hardcopy.

A further finding was that students held opposite views as to whether their portable word processors saved them time in planning and organizing their work. Some said that it was quite convenient to work from the brainstormed or researched data they had recorded onto their machines, while others felt that, because they would have to print out a hardcopy and make revisions, the process was too time-consuming.

From these comments I conclude that a machine such as the WP-2 can help one plan and organize his or her writing; however, it may be necessary to teach students how they can use an assortment of strategies involving preplanning with pencil and paper, organizing their screen-generated data as text-in-process, and revising the planning of their text rendered as hardcopy. This may also require that teachers rethink what the act of pre-writing might entail when mediated by a word processor.

Classroom teachers might find that, for some students whose organizational skills are weak, word-processing text with either a tabletop or portable machine is a less-than-successful venture: while the technology may encourage the student-writer to feel more confident about abandoning pre-planning, there is no guarantee that the student will plan his work "on the go" automatically. In other words, the ease with which the technology permits reorganization of ideas in one's text does not mean necessarily that such reworking will happen.

Encouraging students to employ a planning strategy different from what they may have tried with pencil and paper may not be easy; nevertheless, as Liechty (1989) suggested, the tendency of students using a word processor to not plan their writing necessitates instructional intervention. If CAI software is used to provide questions or prompts to assist the student with the generation of ideas and the organization of his or her writing, I think it is important that the writing teacher preview such software closely, and monitor the degree of success which the individual student is experiencing. Teachers should note that a machine such as the Tandy WP-2 is a dedicated word processor, not a computer, and accessing additional programs such as CAI software with this particular machine is not feasible.

What I would like to see studied further is the effect of utilizing a portable word processor in concert with pencil and paper and with machine-generated hardcopy on planning and organization. Is writing any better organized?

Did using a portable word processor affect *when* students planned and organized their writing?

As mentioned previously, the research reports that writers using word processors engage in less total planning compared to those using pencil and paper. While such writers do plan both at the beginning of and during the composing of a work, such planning is diminished.

The student-participants in my study demonstrated this as well. While some of the students indeed preferred planning their work quite thoroughly prior to beginning their initial draft, others clearly felt that such organization typically occurred later, during composing or revising their work on their portable word processors. One student who initially responded negatively to the survey question "Does the WP-2 encourage planning?" ended up saying during an interview that the machine did assist her in this manner. She said that the WP-2 did not encourage planning during prewriting, but that it assisted her to plan her work later, when she had composed all her ideas on the machine. Most students felt that, since it was so easy to manipulate their text, they did not have to know early in their writing processes exactly where they were heading in their writing.

I was not surprised to hear most students respond in this manner because of the nature of word-processing technology: the ease with which students could cut and paste their thoughts and supporting details using such a machine seemed to a strong factor in the choice of many students to plan as they were writing. Such "planning on the go," finding a paper's focus and development as the writer is generating or gathering ideas, amounts to "re-vision" of one's writing as it is being composed, especially in terms of the order of its ideas.

Some teachers may be a bit uneasy about students engaging in a strategy such as "planning on the go," especially if the student is writing an essay. Will the work maintain a coherent focus or go off on tangential musings? Will it be concise or verbose? On the other hand, perhaps such a strategy is very useful when constructing a short story or any other genre in which the writer, as he writes, discovers. While portable word processors may not cause students to write better, it may cause them to write differently, and teachers need to be aware of this. Word processors can and do modify our writing behaviors.

Future research might find it fruitful to shed more light on these concerns. It may also reveal more fully that there are different answers concerning when or how or for what types of writing a portable word processor might be a better choice.

Did the portable word processor prove a viable tool for constructing a writing outline?

While some studies contended that a word processor can help a writer construct an outline of his or her writing, the specifics of such an operation are in my opinion disappointing. For example, in Strickland (1988), the researcher had his students gain a sense of the organization of a paper-in-process by keyboarding atop each paragraph its main focus. This outline, constructed after an initial draft had been attempted, was intended to show students the extent to which their writing was coherent, unified and focused.

Knowing how to construct and follow an outline for one's expository and persuasive writing seems to be a skill which students are expected to demonstrate in Grade 8. The students in the study either relied on a teacher-designed outline which functioned as a template directing students towards an end product or they devised their own. According to the student key informants, if they were assigned to devise an outline on their own, none of them would construct one using their WP-2 portable word processors; instead, the preferred tool for constructing an outline was pencil and paper.

My conclusions concerning this finding echo what I have offered previously. The nature of any word processor is such that the order of one's ideas can be easily manipulated at any point in one's writing process. This may mean that the once much-assumed advantage of thoroughly planning one's work prior to beginning its composition may become less crucial.

The strategy suggested by Strickland (1988) could, in my opinion, be achieved just as effectively with pencil and paper as with a word processor. Whether one uses a word processor's bold type or underline feature to highlight certain words or phrases or copies such text and places it atop each paragraph, or whether one uses pencil to circle, underline or re-write such text, he or she will be able to see more clearly the focus and direction of his or her ideas.

I would not be surprised if future research into word-processing confirmed the death of the detailed pre-writing outline, an extinction I think few will mourn. In its place there seems to be a growing preference to outline one's work far more briefly and rely instead on the machine's inherent ability to manipulate text. I would be interested in learning the extent to which students print out a hardcopy of their initial draft and, with pencil in hand, engage in re-planning their piece, and whether such factors as age, printer availability, and degree of instruction affect such a writing strategy. Future research might also examine whether, because students can plan later in their writing processes, "writing for discovery" is a viable process for such tasks as essay writing.

Composing with a Portable Word Processor

How were portable word processors used for composing?

Some studies have noticed that experienced writers, as they are composing an initial draft, pause and jot down notes which are metacomments. Such notes are suggestions they make to themselves to consider later in their writing processes. Neuwirth et al. (1990) noted that with writing with a word processor such notes were quite limited, focusing mainly on matters of content. As well, some studies have noticed that during the act of composing writers frequently engage in "in-process" revision. As Beserra (1986) put it, such writers "revise differently" from those using pencil and paper who generally revise toward the end of their writing processes.

Whereas many of the students in my study tended to use their WP-2s in a limited manner for such prewriting tasks as brainstorming, thought webbing and constructing an outline, they were much more likely to make use of their portable word processors when composing their writing. For many of the students, the ease with which text can be manipulated by the WP-2 was particularly inviting: they felt that, because of the cutting and pasting functions inherent in the technology, they could concentrate on the content of their work and concern themselves with organizing their thoughts later in their writing processes.

A second finding was that, just as prewriting strategies differed from student to student, the composing strategies of the students were also individualistic. During my study at St. Ethos, with the exception of the composing of one particular genre which I discuss later, I observed no dominant strategy of use involving the machines: some students may compose an initial "junk draft" with pencil and paper and then create further drafts with their WP-2s while others may utilize their portable word processors throughout their composing process. A generalization I might make is that for pieces of writing which were more expository, such as essays, a word processor was most often the tool of choice; for writing which was more reflective, such as stories or poetry, pencil and paper most often was preferred.

I think that such varied use of portable word-processing for composition is the product of most of the students having chosen when to use such a writing tool after some degree of experimentation and deliberation. Most of the students I talked with and observed understood why they were or were not using their WP-2s for composing a draft.

In terms of classroom practice, I think it might be worthwhile to once again invite students to share with the class how they are or are not using their WP-2s for composing a work so that some of the students who are still exploring how to utilize the machine can make better-educated choices. Further research might examine the extent to which other

students using word-processing technologies prefer a strategy whereby they write an initial draft by hand and then transpose the text onto their machines. I would be interested in knowing more about the factors which influence such a decision.

Why did some students prefer to compose their initial drafts using a portable word processor?

Liechty (1989), in her review of the research, found that most writers of all ages and abilities preferred composing with a word processor rather than with pen and paper; however, Snyder (1990) found that composing behaviors varied according to the genre of the task (narration, argument, report) rather than according to the influence of the writing tool. Mathieu (1989), in her exploratory study of grade seven students, found that they most effectively wrote their initial drafts of stories using pencil and paper. Interestingly, most researchers do not report on the types of writing being attempted by the writers being studied: of the few who do, the types of writing most frequently observed have been essays and some short stories.

I found that, regardless of the genre to be written, those students who preferred composing their initial drafts using their WP-2s had many reasons for doing so: it saved time in that it was faster to keyboard than to write with a pencil and they did not have to rewrite entire drafts by hand; by being able to keep up with their thoughts, they were able to set down their ideas quickly before they dissipated; with the extensive writing which at times is associated with composing, keyboarding was easier on their hands and they were less likely to get "writer's cramp." They were also able to write recursively: they were able to move back and forth, working with one segment of their writing and then another, and to shift from composing to planning to revising as their Muses so instructed them.

While I was not surprised that many of the students preferred to compose initial drafts of their work, especially expository writing, on their WP-2s, I was surprised at the variety of reasons for doing so. I think the fact that these young writers had so many reasons for composing their work on the WP-2 demonstrates that students tend to use a technology in ways which suit their purposes best.

While the classroom teacher may believe that it is most beneficial for students to utilize portable word processors in an individualistic manner, there is still a need for instruction. Not every student understands the same things about writing and about how to utilize his or her portable word processor; therefore, as I suggested earlier, it might be advantageous as a teaching strategy to encourage students to share with the class how they have been using their machines and why. As well, I think it is important that students be allowed to choose which writing tool to use for the writing of an initial draft.

Further research might reveal the extent to which the aforementioned reasons are prevalent in the classroom and what other reasons students may have for composing with their portable word processors. As well, future research could look much more closely at the types of writing which students are composing, and whether such a consideration influences whether students compose on a word processor.

Why did some students prefer to compose their initial drafts using pencil and paper?

Most of the student informants in my study preferred writing out a rough draft with pencil and paper if the genre being composed was poetry. For such writing, the student would reach for his or her portable word processor least frequently.

These students described two reasons for shying away from using their portable word processors while composing poetry. Sometimes the students felt that the format of a poem was crucial, and they found pencil and paper to be less restrictive, more accommodating in this regard. At other times, it was very important to the students to be able to see all of the text they had already written. In both situations the WP-2 would be brought into use eventually, but only after the initial draft of the poem had been completed.

Another type of non-expository writing which some students might prefer drafting using pencil and paper is short story; however, most of the students' responses demonstrated that they had no strong preference. It is also worth noting that a few students said that they preferred using their portable word processors for short story writing, for they were able to compose faster and keep up with their thoughts.

I was not surprised to find that some reflective writing, especially poetry, was frequently drafted using pencil and paper. Drawing from my own experience, although I have written many poems, I can count on one hand the number of times I have sat down and composed some verse using a word processor. While others might be successful at composing a poem on a word processor, I have to use pencil and paper: for some reason, whether it be that I feel more in touch with my Muse or that I sense a more personal voice in my own handwriting, the act of taking pen or pencil in hand seems to strike a more personal, more harmonic note. It is only after I have an initial draft in front of me that I turn on the word processor. Similarly with the writing of a personal narrative I find that I feel more comfortable or "in synch" using pencil and paper to construct an initial draft.

In terms of teaching practice, the classroom teacher might examine whether some students feel more comfortable using pencil and paper for the initial draft of certain types of writing. It may be that such a preference has little to do with whether a student is proficient with keyboarding; rather, at times pencil and paper may just "feel right."

It would be interesting to see what further research might reveal concerning the "feel" of pencil in hand and the type of writing being attempted. Is writing which might be more personal and reflective better done with one type of tool than another?

What other factors seemed to influence student choice of tool for composing a piece of writing?

Another finding in my study was that, for many of the grade eight students, their choice of tool for composing a piece of writing was largely influenced by two interrelated factors: by their comfort level with using that particular tool, and by the importance they conferred on feeling comfortable during that stage of their writing. Echoing the data expressed earlier in this chapter concerning brainstorming, the attitude of many of these students is that it is paramount for effective composing that they feel comfortable with what they are doing and that they are able to concentrate on the particular task at hand. As a result, these students tend to write using pencil and paper: for them, it is a more familiar, and therefore a more comfortable, tool.

It is my belief that, as student populations become more experienced with word processing at younger ages, the comfort level associated with using a word processor undoubtedly will increase. Perhaps the day is not far off when, for most students at this grade level, the word processor will be the tool of choice for those tasks where it is crucial that distractions and frustrations are minimized.

Yet another finding was that some of the teacher participants may unintentionally have dissuaded their students from using their WP-2s for composing a rough draft of certain writing tasks. While I think it is preferable that teachers require that only the "polished" draft be word processed, some students may interpret this requirement to mean that for only the polished draft is it worth turning on their portable word processors. Similarly, if one leaves the choice up to the student as to when to utilize such a machine without teaching the student the benefit of each choice, the student may quite literally make an uneducated choice. At St. Ethos, the task of instructing the students about when and how to use their machines seemed to fall mostly into the lap of the language arts teacher; some of the other teachers did not instruct their students about making such decisions, preferring instead to leave it up to the student. I must add that this instructional strategy is understandable, for the Tandy WP-2 was as new to the teachers as it was to the students: both parties were "feeling their way along" with the machine.

Concerning this latter finding, the implication for teaching is that not only the language arts teacher but other teachers as well should provide instruction concerning how students might make use of their machines. I share the belief with other colleagues that writing is not the domain of just the language arts teacher: all teachers are teachers of

writing. It follows then that all teachers, in assuming this responsibility, could be teaching the students the functions of the computer and the applicability of the tool for various writing tasks, thereby not placing the task of such instruction on the shoulders of any one teacher or any one program.

I envision that such an implementation strategy might require a few things: first, all the teachers would have to know how the particular portable word processor works; secondly, the teachers would have to understand the nature of process writing; and thirdly, teachers would have to take the time to reinforce those functions and allow for such writing. As all teachers would be introducing such skills and concepts, all would be reinforcing them. In that way, students would be getting such reinforcement throughout the school day and would both learn the functions sooner and learn more quickly how to use their machines in their individual writing processes.

Ms. Hansen thought that that having students learn the word processor's functions from all their teachers was a worthwhile suggestion:

> I think that would be a good idea. Now, it's not like I taught them everything about the functions, because they did other things in other classes.... What you said would be great if we all knew what that machine could do and were ready to apply it to each class. It would have saved a lot of time.

Future research might reveal some more definitive conclusions concerning these two findings. When it comes to composing a piece of writing, is "keyboarding comfort" for increasingly-computer-literate students a rapidly-declining concern? As well, are there some teaching practices which might unintentionally be affecting student utilization of portable word processors negatively? Extrapolating from this last concern, is what I perceived as an apparent abrogation of writing instruction by non-language arts teachers a common phenomenon in the secondary grades?

Revising and Editing with a Portable Word Processor

Regardless of the writing tool, what changes did students tend to make to their writing?

Some studies have reported that experienced writers engage in extensive revision, and that this behavior distinguishes them from younger, less experienced writers; however, others have reported that, regardless of age and the type of writing tool being used, most changes are to surface features of a text; few are substantive. Some studies have even noted that students writing with pencil and paper made more significant revisions than with a word processor. Some research has reported that, when students printed a hardcopy of their text, revision quality approached the results found when students used pencil and paper only.

It is important to also mention that, although many of the students in this study demonstrated limited ability to make higher-level changes to their writing, this is not necessarily the norm: Atwell (1987) and Hancock (1992) have described groups of junior high students whose revision strategies were very sucessful.

The grade eight students whom I observed tended to concentrate on making corrections to writing conventions--the spelling, punctuation, and grammar of their writing --rather than on making changes to such things as word choice and sentence variety and effectiveness. These students tended to view "revision" as "correction" of their writing; consequently they tended to concentrate on making changes to their writing which would improve its correctness. As some of the participating students and teachers noted, the concepts of revision and editing tended to have been learned together, and this might account for students having concentrated on some things which are more specific (for example, correctness of spelling) rather than having attended to those things are more general (for example, sentence effectiveness and paragraph unity).

My feeling is that students at this grade should be able to differentiate between revision and editing, but that students may need them taught as discrete skills. I also wonder whether the presence of a spelling checker, and in particular its ease of use, makes such young writers concentrate more on correctness than craft.

By teaching revision and editing as separate lessons, the classroom teacher might assist students to understand better the difference between the two concepts. Another strategy which might reinforce the worth of including both revision and editing in one's writing processes could be to direct one reader to look over another student's writing task for such things as diction and sentence effectiveness and then to direct a second reader to look over the same task for correctness.

I would like to learn whether this tendency to make changes to one's text in terms of its correctness rather than in terms of its effectiveness is a common phenomenon in the middle grades. I would also be interested in learning whether teachers themselves in the various subject areas differentiate between revision and editing. Further, I would like to know whether the presence of a spelling checker influences student conceptions of and behaviors concerning revision.

When did the student writers engage in the act of revising and editing?

As previously stated, the research reports that with the use of a word processor, a writer tends to make revisions not only at the completion of an initial draft but in-process as well.

For many of the student participants the act of revising and editing was not something in which they all engaged in a similar manner: strategies differed from student to student. While some of the student participants did wait until they had finished composing their texts before they began making changes to what they had written, other participants began making changes to their texts as they were composing.

Some of the time, making changes to their texts appeared to be affected by the students' moods. Whereas with one assignment they may have worked on making changes to it once they were finished its composition, with another task they may have revised and edited while they were composing the text.

I was not surprised to observe that student choices as to when in their writing processes they engaged in revising and editing their work seemed to be as individualistic as with other stages of their writing, for a variety of writing methods and processes seemed to be demonstrated by most of the students in the two classes observed. I sensed that such behavior was the result of classroom atmospheres in which the students were expected to use ways and means which seemed to best satisfy their needs as writers.

I am of two minds concerning the above findings. On one hand I applaud a teaching strategy in which the student-writer is encouraged to do what he wants whenever he wants concerning his writing process, for such instruction recognizes the recursive nature of process writing. At the same time, however, I am concerned that for some students the act of engaging in revision and correction too early in their writing processes may interfere with and possibly even take away from other parts of their writing, such as the generation and organization of ideas.

Teachers who share my concerns might find it fruitful to have the class describe their writing strategies, and discuss the advantages and problems which they have experienced. In this way, students can consider and experiment with such strategies, and adopt whatever work best for them.

Teachers may also find that, if students are making revisions and corrections to their work at any point in their writing processes, they may be required to assist different students in different ways. Just as students will most likely acquire an expanding "repertoire" of writing strategies with using the portable word processor, teachers will most likely have to have at the ready a similar variety of teaching strategies.

Further research may show whether in those classroom where word-processing is a dominant tool for writing there is such variety as to when students revise and edit their work. It may also be shown whether engaging in revision and editing at an earlier point in one's writing process and using a portable word processor for such purposes has any

effect on the quality of a student's writing in terms of its content, organization, style and correctness.

Further Aspects of Writing with a Portable Word Processor

In the course of conducting my exploratory study, a number of additional concerns arose concerning writing with a portable word processor:

- the role of hardcopy;
- the effect of the technology on collaboration;
- the effect of a spelling checker on student writing;
- the effect of the technology on diction;
- the effect of the technology on writing quality;
- the effect of proficiency on using the technology; and
- the role of pen and paper in writing with a portable word processor.

The Role of Hardcopy and the Portable Word Processor

How important was it for students to have a hardcopy of their writing-in-process?

Several studies have offered mixed reviews concerning text rendered on a computer display monitor. Some studies have found that screen-rendered text may stimulate additional monitoring and rereading of the writing, and may enhance attention to structural editing. However, most of the studies examining this aspect of the technology have found that the limited "seeing" offered by display monitors deters writers from making large scale organizational changes using only the machine. To assist with gaining a sense of the "big picture" of their writing, students may frequently print out a hardcopy of their text-in-process. Some studies have also contended that a hardcopy helps the writer highlight problem areas in his or her text, and that it may also make the writer more conscious of errors in the conventions of the language.

I found that, for several of the student participants, the need to have a "big picture" of their writing-in-process resulted in them wanting to have some form of hardcopy in front of them. To obtain this necessary hardcopy, these students either did all their prewriting and early drafts by hand or they repeatedly printed out a hardcopy of their work from their machines.

For those students using their WP-2 portable word processors, the machine's small liquid crystal display screen was seen as a drawback: it did not display enough of their text. While they felt that shorter pieces such as short answers or paragraphs might be easily constructed and displayed on the machine's screen, these students felt that longer pieces of writing such as essays would be better seen as they were being composed onto paper or

onto a larger screen such as that of a tabletop computer which could display up to 32 lines of such writing-in-process; however, most of these students found that an easier solution was to print out a hardcopy of their writing-in-process at different stages in their writing processes.

I found it interesting that not all students seemed to realize that the limitations posed by the machine's display screen could be overcome by simply printing a hardcopy of their text. On occasion, it seemed as if some of the students were not demonstrating enough familiarity with possible strategies which might assist them in using their portable word processors to their fullest.

What may be needed is for teachers in the various subject areas to remind students when necessary of the various difficulties which might arise with using their portable word processors and some ways in which such hurdles might be overcome. Following the advice of Lutz (1987), I think teachers would need to constantly monitor the writing-in-process to see whether higher-level structural changes are being attempted, and the writers would need frequent encouragement to utilize a hardcopy of their work for the purposes of making such changes.

Future research might explore the extent to which teachers in the various subject areas whose students are using portable word processors are demonstrating such constant monitoring and mentoring, and the effect it has on encouraging higher-level changes to writing.

When was it necessary to have a hardcopy?

The research concludes that students may need to print a hardcopy of their writing at different stages of their writing processes. Neuwirth et al. (1990) found that writers use hardcopies to reorganize, to proofread, to check format, and to gain a sense of the text. The longer the work, the more frequently such a need was expressed.

The study's data strongly suggest that because students may engage in the act of writing differently, knowing precisely when one student may want to obtain a printed hardcopy of his or her wordprocessed text is difficult. The need to use a printer may occur at almost any point along the spectrum of a writing process, whether it be to create a hardcopy of a student's brainstorming for the purpose of organizing one's ideas or to print a revised draft for the purpose of being proofread by a classmate. Some students may want to print some work early in their writing process while others may want to print later, and some may want access to a printer several times while working on a piece while others may want to print just once.

The above findings are very meaningful. As an English teacher, I am interested in helping students use whatever writing strategies prove most fruitful for them, and this

attitude requires that I value student's individual writing processes. While I place considerable emphasis on how a certain piece should be in terms of product, how the student gets there is his or her choice.

In terms of teaching practice, this means that I embrace a certain set of paradigms. One belief might be expressed in this manner: just as there is no one "correct way" or "better way" to teach, there is no one "proper way" to write. This means that students need to have a repertoire of writing strategies from which to draw.

Another paradigm I hold is that a writing classroom should facilitate the needs of the student-writer. This second belief seems to require flexibility on the part of the classroom teacher to allow time for printing and access to printers while the class is working on a piece of wordprocessed writing. Providing such constant access to printers might further necessitate having more than one printer in the classroom and having printers which are far quieter than those which are commonly provided. The 1-to-3 printer to computer ratio described by Holian and Chismar (1991) may be appropriate.

Future research could explore whether such paradigms and support hardware are indeed necessary to facilitate the effective use of portable word processors in general and the printing of hardcopy in particular in various classrooms.

How important was printer availability?

Several studies have concluded that printers are an important part of process writing. The writer may need to print a hard copy for his individual purposes at any stage in his writing process, or a hard copy may be needed for the writer to receive feedback from others.

Having an immediate hardcopy of their writing-in-process was felt by many of the student participants to be crucial to their writing processes, and strongly influenced their choice of writing tool: their perceptions as to whether they would be able to print a hardcopy of their work was a deciding factor in whether they turned on their machines. If they predicted that it might be unlikely that they would be able to run a copy of their work, or that it would be too inconvenient, the machines would remain put away and the students would obtain their hardcopy by means of pencil and paper.

Strongly connected with this concern was one voiced by many of the students about printer availability. Although most of the teacher participants felt that such was not the case, the students' perceptions were that a printer was not always readily available. This perception resulted in many of the students relying on pencil and paper for a hardcopy rather than relying on their WP-2s.

I also found that there was an area of strong disagreement between teachers and students about the availability of printers and the amount of time needed to obtain a

hardcopy of one's writing. While most of the teachers in the study perceived that the availability of machines and the immediacy of hardcopy was on the plus side, the perceptions of most of the students was just the opposite: to many of the students, a sense that they might not be able to print a hardcopy quickly frequently influenced their decision to abandon use of the machine in favor of pencil and paper.

I think what is important here is to recognize the perceptions being held by many of the students, for such perceptions are affecting whether they are making use of their portable word processors. At issue here is not who is more accurate in his or her perceptions but that these perceptions seem to be having considerable impact on the successful use of the technology in the various classrooms.

I feel that the implications for teaching here are fundamentally important. If the students are saying one thing and the teacher another, it is important for the teacher to monitor and evaluate what is occurring in the classroom and decide what modifications are necessary. The goal should be to address student needs, particularly the need to have immediate access to a hardcopy of work-in-process. More than one printer is needed in a writing classroom, and access to such hardware should be continual during whatever times are set aside for writing activities.

Further research may reveal further the extent to which printer availability affects machine utilization, and whether having more printers in the classroom has an effect on the quality of writing being completed.

What other influences affected students printing hardcopy?

During my study, I observed three student attitudes about hardcopy which I had not predicted from my review of the published research.

Hardcopy: to hand in or not to hand in? For many of the students in my study, what greatly influenced whether they would use their WP-2s was knowing whether a machine-printed hardcopy of whatever they were writing was required to be handed in. If it seemed that the teacher was not requiring that the students hand in a printed hardcopy of whatever writing task was being attempted, these students would opt for doing their work with pencil and paper.

Hardcopy as end product. Another perception held by some of the students was that the act of printing one's work is something only to be done at the end of one's writing process, when the writing has been polished. For these students, printing copies of their brainstorming or their rough work were not strategies which they considered worthwhile.

Hardcopy as harming the environment. A further perception held by some of the students was that running hardcopies of one's work-in-process is somehow

wasteful: in the two classes observed, student concerns about the environment frequently seemed to outweigh a belief in the worth of using their word processors and printing a hardcopy.

Such responses as the three described above suggest to me that many of the students in the study tended to view the role of hardcopy in their writing quite narrowly: it was something they handed in when the teacher asked for it, it was a final act in writing, or it was wasteful. Most of these students thought, it was not worth the additional amount of time and effort necessary in printing a hardcopy. Further, while I feel it is commendable that students have acquired a sense of how they impact on their environment, I think that denying themselves hardcopies of their works-in-process is rather false economy. One decides to use a portable word processor because it will help with one's writing, and if a person needs to have a hardcopy of his or her work-in-process then the person should print a hardcopy. As Neuwirth et al. (1990) suggested, a "paperless" writing curriculum should not be encouraged.

I believe that students with a very limited or simplistic understanding of the act of writing will not be able to take full advantage of the possibilities offered by a portable word processor. If such limited understanding is predominant in the classroom, it needs to be addressed by the teacher quite early. Once again, it is paramount that students be shown which strategies may be more appropriate and that they be provided with adequate support hardware.

Future research might confirm the frequency of such attitudes and find others as well which impact on whether students with portable word processors are printing hardcopies of their writing-in-process. As well, such research could demonstrate whether there is a correlation between such attitudes and the extent to which the machines are being used.

Collaboration and the Portable Word Processor

The research strongly contends that collaborative learning contributes to student growth in terms of such things as encountering and understanding multiple perspectives, improving judgment and socially-constructed meaning. As well, collaborative activities may contribute to creating voice in writing, understanding audience, and improving planning and revision. These aspects, taken together with the culture of junior high school and the public nature of wordprocessed text, may persuade one to conclude that collaboration is an appropriate as well as important part of process writing.

One would assume that a portable word processor, because of its portability, would be well suited to the act of working with a writing partner collaboratively. Besides its portability, the machine's inherent nature to render text as print would also lend itself to

collaboration. The data I gathered suggest that a portable word processor may contribute to effective collaborative writing for some, but at the same time its inherent design may discourage others from using such a machine as part of their collaborative processes or cause them to abandon such collaboration entirely.

Why did most students collaborate on their writing?

The data gathered by interview suggested that most of the student key informants in the two grade eight classes collaborated with a writing partner fairly frequently. It was generally felt by most of these students that a writing partner could help generate ideas. As well, a partner could look at one's text-in-process fairly objectively and note such things as organization and writing errors which the writer might tend to overlook.

Direct observation showed me that, while most students worked with one another on their writing assignments, almost half the class did not seem to be engaging in such collaboration with a writing partner. Ms. Hansen offered the opinion that, although the WP-2 can generate printed text which is very legible, compared with pen and paper writing in previous years, it had not increased the frequency of students providing feedback to one another about their writing.

If such observations are correct, it might be that the technology's ability to render legible text is not enough by itself to persuade students to read one another's work for the purpose of providing feedback; rather, there may have to be planned into certain lessons some opportunities and instruction for students to read one another's text.

The observations and interviews I completed during my time at St. Ethos convinced me that many of the students valued working collaboratively with a partner on their writing. Positive attitudes about collaboration were also voiced by several of the teacher-participants, suggesting that the teachers viewed writing as something which lent itself to cooperative activities. At the same time, however, the responses of those few student-participants who tended to shy away from collaboration revealed to me that a few students in any given class may not value working with a classmate on their writing. Some students, for whatever reasons, may not want their peers to see their writing. Others may view collaboration on writing as something which is done at the end of the writing process, a time when, as I describe below, there is not much time to have a reader look over one's work.

While I am tempted to say that those students who shun collaborative writing should be allowed to work on their own, I cannot help but wonder whether they have ever had a positive experience with working with others on their work-in-process. Perhaps it is necessary for the classroom teacher to create situations in which the reluctant student is a part of a collaborative writing experience and monitor the behaviors of the reluctant student

in such a grouping. For those reluctant students who say that there is not any time for collaboration, the classroom teacher can design his or her lessons to include such opportunities.

Insofar as future research is concerned, I would like to know more about why some students value having a writing partner and engaging in collaborative writing and why others do not. As well, I would value hearing some teaching stories from the lived world of the students recounting what such collaborative endeavors have meant to them, including the effect of such activities on their attitudes toward writing.

When did writing partners collaborate?

The research suggests that students may collaborate using a word processor at various stages of their writing processes. Most researchers examining collaboration have focused on the peer teaching which occurs after an initial draft has been written.

I observed that one stage in a student's writing process which seemed to lend itself to the act of collaboration was brainstorming. The adage "two heads are better than one" seemed apt as I observed students pairing up and bouncing ideas off one another. Some students mentioned that they found that having a portable word processor in front of them as they were engaging in such talk facilitated the task in two ways: they were able to keep up with the other person's thoughts and make changes directly onto each other's machines. One of the teachers commented that such collaboration may be most appropriate at the planning and researching stages of one's writing process rather than at a composing stage.

I was unable to make any worthwhile observations concerning whether a portable word processor would or would not be of use for collaborative writing during the act of composition, for during the time I was at St. Ethos there seemed to be little in-class time for students to engage in the writing of an initial draft. As several of the teacher-informants remarked, most of the actual writing by the students was being completed outside of class. One teacher remarked that he usually did not encourage collaboration at the composing stage, feeling that he would be able to hear the individual student, to apprehend his or her ideas more clearly, if the student had worked alone.

I observed only a few students who were assisting one another with the writing of an initial draft or providing feedback concerning things as ideas, structures and word choice with the intent of making revisions to their texts. Because of the tendency of some teachers to have their students use time out of class to complete their writing assignments, only those who worked fastest in the classes got to such a point in their writing. I had to obtain most of my data concerning composition and collaboration through interview.

When writing time was provided during a subsequent class, students seemed far less concerned with making revisions to their writing than with making corrections. At this

stage in their writing, they would ask their writing partners to proofread their wordprocessed text. I noticed as well that when a paper was due there seemed to be little time provided for proofreading: the paper was simply handed in.

In my own classroom, I encourage students to help one another with their writing, and the data I gathered at St. Ethos convinced me that collaboration using a portable word processor can assist students engaging in brainstorming and proofreading. Although the students did not seem to put much effort into making revisions to their writing, more opportunities through instruction might have strengthened such an enterprise. I suspect that a portable word processor is also a tool well suited for writing partners looking at such things as ideas, structures and word choice.

I think the classroom teacher would find it fruitful to encourage collaboration during as many stages of a student's writing as possible. When the student is helping his or her writing partner, he or she enters into the role of being a teacher, further reinforcing what he or she understands about the act of writing. As well, by having someone respond to the student's writing-in-process, I think the student may acquire a better sense of not only the particular audience for whom the piece is intended but a better sense of what an audience is in general.

Concerning future research, I would like to see whether in classes where there are more opportunities for collaboration a portable word processor is a helpful tool. As well, I think it would be worthwhile to look at how some teachers design their classes so that there are frequent opportunities for students to work together in this manner. Further, I would like to learn whether collaborative writing improves a student's writing in terms of quantity and quality, whether it affects a student's awareness of audience, and whether it affects a student's sense of authorship.

How did students collaborate and what were they doing?

The research informs us that students engage in a variety of actions when they collaborate: they discuss the assignments in ways that clarify the task, they summarize and explain, they model, they confront and discuss both misconceptions and ineffective strategies, they become recognized by their peers as having expertise, they talk and teach and learn.

Although during my time at St. Ethos I saw only a few instances where students were actively engaged in using their word processors for writing other than note taking, what I did see suggested that most of the students did seek out a writing partner to receive feedback at some point in their writing processes. How the students engaged in such collaborative efforts suggested a common strategy: the students would exchange their machines, read one another's text as displayed on its screen, and offer suggestions for

improvement. Much of the time, the reader would make such changes directly onto the machine.

Almost all the students I asked commented that it was difficult to read the liquid crystal display of a writing partner's machine unless it was directly in front of them. This proved problematic for collaborative writing: having the machine in front of one of the writing partners meant that the other person, sitting to the side and at an angle to the screen, would have difficulty reading the screen-generated text.

In spite of the complaints I observed and heard concerning the difficulty of working collaboratively with text rendered on the WP-2's LCD screen, and although some of my key informants described working from hardcopies of a classmate's text, I seldom saw students responding to a hardcopy. Most tended to rely on screen-generated text for collaboration. Two of the teacher-participants also commented that they noticed the students tended to rely on screen-generated text. When I did see students read a partner's hardcopy, I noted that a few tended to white-out text using correction fluid and then proceeded to make changes in pencil.

Just as I think that collaboration is worthwhile and that a portable word processor is well suited for such writing, I think that printing a hardcopy of one's writing-in-process for the purpose of feedback from one's writing partner makes considerable sense. I view it as being an integral part of collaboration between writers using portable word processors. As suggested earlier in the chapter, this may entail students wanting to print at different stages of their writing processes.

Another strategy students could employ would be to include the use of a tabletop computer during collaboration. Students could download text from their portable word processors onto a tabletop computer, and, taking advantage of its larger, more "public" screen, assist one another in making changes to their writing.

Further, insofar as lesson design is concerned, to maximize the potential of collaboration using a portable word processor, teachers could provide frequent opportunities for such collaborative efforts during class time. For instance, time could be provided for responding to such things as effectiveness of word choice, clarity of expression and adequacy of supporting detail. Providing time during class for students to look at one another's texts with the intent of making revisions would communicate clearly that such revision is important and that collaborating on revision is a worthwhile enterprise.

Future research could reveal further the importance of hardcopy in collaborative writing, and whether certain teaching interventions affect both the nature and frequency of such collaboration.

Using the WP-2's Built-in Spelling Checker

Although William Wresch (1987) has tended to view the use of spelling checkers rather negatively, other researchers have viewed them more positively. Balajthy et al. (1990) contended that such programs as spelling checkers and style analyzers can assist a writer by performing a preliminary analysis of targeted writing features, allowing the writer to make whatever correction and revisions are needed before submitting the composition for review. As well, such software programs encourage increased writing and closer attention to editing, and establish an effective setting for peer discussion and group feedback.

I found that, unlike other aspects of the grade eight students' writing processes, there was a high degree of uniformity as to when and how they would use the machine's built-in spelling checker. All eight student key informants responded that they tended to check their text for spelling errors after they had finished writing a draft, and all did so by using the machine's Spelldoc function. For some students who were weaker at keyboarding, the Auto spell check function which sounds an audible tone whenever the student types an unrecognizable word was helpful: it served as a typing checker.

I was not surprised to find that all of the student key informants and many of the other students in the two classes used their spelling checkers at the completion of writing a draft: it seems an appropriate point at which a to check on the correctness of a work's spelling. However, I was a bit surprised that students were not using their machines more consciously to assist them in keeping track of what words they were in the habit of misspelling.

Teachers might want to encourage students to be concerned about checking their spelling later in their writing processes, explaining that such matters as content, organization and craft should be considered before turning one's attention to correctness. On the other hand, some students might prefer to employ a strategy whereby they are composing with the auto spell check operating. If these students view this latter strategy as being beneficial, I think it should be permitted. While some teachers might find the audible tone of the WP-2's auto spell check function distracting, the students in the study did not seem to share that assessment. Once again, I think it is best if the choice of writing strategy is left up to the student.

The "field" seems wide open for some effective inquiry into the use and possible benefits of spelling checkers, regardless whether the program is found on a tabletop or portable machine. Future research might also examine whether the presence of a spelling checker program might suggest inadvertently to some students that what is important in writing is spelling, and whether such an impression affects other, more important, matters

in writing. As well, it would be interesting to learn whether some students interpret the presence of a spelling checker as meaning that learning to spell is not important.

Does the Presence of a Built-in Spelling Checker Help the Student Become a Better Speller?

While some researchers reported that wordprocessed writing demonstrated better mastery of conventions, particularly spelling, they did not answer whether the technology had helped students become better spellers or whether such writing was merely the product of having been corrected using a spelling checker programs.

In my study, almost all of the student and teacher participants agreed that the correctness of the spelling in the writing completed on the WP-2 portable word processors had improved. Further, the opinion of half of the student participants was that they felt they were becoming better spellers as a result of using the machine's built-in spelling checker.

I must admit that before I began my study I had some reservations concerning whether a built-in spelling checker would be a positive feature on a portable word processor. The interview data provided from my key informants have convinced me that it is very possible that such a feature can improve a student's ability to spell correctly.

I think what may be crucial here is to make sure that the machine does not simply become something which corrects the student's spelling time after time without the student gaining from being told which words are being misspelled. With my own students, regardless of the writing tool they have been using I have them keep a page in their notebooks where they keep track of which words they have been misspelling. The idea is that by keeping such a list the students will be more aware of which words they are having difficulty spelling correctly, with the intent that eventually they will be crossing out those words which they no longer have difficulty spelling correctly.

I would be interested in knowing more about how other groups of students have made use of built-in spelling checkers, and whether there is convincing research which shows the effect such a feature has on student writing. At the time of this writing, there certainly seems to be a dearth of inquiry into whether the use of a spelling checker affects student spelling ability: Does correctness of spelling improve? The remarks of those who participated in my study concerning the positive effect on spelling ability of using the WP-2's spelling checker may have been wishful thinking.

Diction and the Portable Word Processor

It has been my experience that students attempting a writing task without having access to dictionaries tend to leave out those words whose spellings they are unsure of, substituting other words whose spellings they are more confident about. In such instances,

vocabulary which is important to use in a discussion pertaining to course content, but which the students find difficult to spell, is frequently avoided. However, when I first began my study, I had hoped having a spell-checker program in a word processor which accompanies the student throughout the day's timetable would facilitate word choice.

I imagined that, rather than feeling inhibited from using appropriate vocabulary because they had not yet mastered the spellings, students might feel encouraged to use the language appropriate to the subject area. Specialized course-specific vocabulary can be easily added to the word bank of most spelling checkers, including the WP-2. As well, rather than learning lists of vocabulary by rote, students can be tutored by the spelling checker as they use the language in the context of real writing until they have mastered the spellings.

My review of the literature proved disappointing. I had expected to find studies which examined the impact of word processors on word choice in student writing, especially those software programs which included a spelling checker. The few that did examine diction focused on the effect of computer-assisted programs, particularly style analyzers, and offered little to satisfy my inquisitiveness: for example, Pufahl (1986) contended that spelling checkers could help writers maintain more variety of word choice in their writing by helping them compile such word frequency lists.

My observations and discussions with the grade eight student participants also proved somewhat disappointing. While most of the students felt that the immediate availability of a spelling checker affected their word choice, many seemed to be primarily concerned with not wanting to overuse some words or wanting to impress the teacher with having used a more sophisticated vocabulary.

When I questioned the students more specifically as to whether using a spelling checker had encouraged them to use more difficult-to-spell words I got a somewhat more satisfying response. When asked, the majority responded that the WP-2's built-in spelling checker had affected their word choice: they felt less hesitant and more confident in using such words because of the convenient availability of the machine's built-in spelling checker.

In spite of students' reassurances, I wondered whether they were telling me what I wanted to hear. When I consulted the teachers, several of them felt that, in the particular classes observed, very few students were demonstrating a sensitivity towards diction, either in terms of its appropriateness or its effectiveness.

I continue to question whether the full potential of the particular portable word processor, a Tandy WP-2 with a built-in spelling checker and thesaurus, was being

recognized by the student writers. I wonder too whether such awarenesses are demonstrated more frequently by students who are older.

To the classroom teacher these findings and conclusions might suggest that students need to be sensitized about diction, that they need experiences which will help sharpen their attentiveness toward word choice. The classroom teacher might find it worthwhile to plan exercises whereby the students with portable word processors are engaged in using the built-in thesaurus. Perhaps by providing more opportunities for students to consider the importance of word choice, such a concern will become second nature for more students.

Concerning future research, just as there appears to be a dearth of study into the effect of spelling checkers on student spelling ability, there seems to be an equal absence of inquiry into the impact of such programs on vocabulary. Further inquiry might discover the degree to which students are making use of the portable word processor's thesaurus to assist them with word choice and whether such a technology has heightened student sensitivity towards matters of diction. A number of meaningful questions remain to be answered:

• To what extent are students in Grade 8 concerned about diction? To what extent does the 'agenda' set by the teacher affect whether students pay attention to word choice?

• What understandings do they have about word choice? Do such understandings include word appropriateness and word effectiveness?

• Does a simple spelling checker program such as the one featured on the Tandy WP-2 affect student word choices? Does it encourage hard-to-spell wording?

Writing Quality and the Portable Word Processor

Availability, Portability and the Effect on Writing Quality

Researchers have had a difficult time assessing not only whether word processors affect writing quality; they have difficulty defining what exactly writing quality is. An additional observation I make from having read the research is that the instructional backgrounds of the various researchers often seem to affect how quality is defined. Some working with post-secondary students may define quality differently from those working with students in the elementary grades. Others with a familiarity with computers may assess writing quality differently from those who are English language arts teachers. In my opinion, at the time of this writing "the jury is out" concerning whether a word processor, tabletop or portable, affects writing quality.

I am not able to conclude from direct observation whether, for some students, the presence of the technology had made them better writers. The relatively short amount of time I spent in the classroom and the few instances of writing which I observed did not furnish me with data from which to weigh such a consideration.

Interview proved a bit more fruitful. A few of the teacher-participants offered that, with the exception of improved spelling, there were few noticeable improvements in the quality of writing done with a portable word processor. However, one teacher remarked that he had not been looking consciously at the effect of word processors on writing product. Understandably, such measurement was not yet on the agenda of these teachers as they were still learning about the place of the technology in their programs. Furthermore, two of the teacher participants stated that there were a number of variables which might account for whatever seemed to have been improvements in writing.

The student participants were a bit more optimistic that the portable word processor may have affected writing quality: most students' remarks suggested that the WP-2 had had a positive impact on the organization of their writing. However, teacher feedback concerning this idea was divided: while one teacher had noticed an improvement in student writing in terms of organization of paragraphs in those papers composed using the WP-2s, another teacher said he was unsure whether the WP-2s had affected the written product in any way.

We still await research which ushers the "jury" back in and delivers a sound verdict on writing quality.

Proficiency and Portable Word Processing

One aspect of introducing a new technology into the classroom is that some students will utilize it more effectively than others. While increasing numbers of students entering junior high school may be very proficient at using a portable word processor, there are others whose proficiency is weak and who, feeling discouraged, may shy away from using it.

The research confirms what common sense tells us: students who are not proficient at keyboarding or have not learned a word processing program's various commands will tend to underutilize the tool. I sense there is a bit of a "Catch-22" involved with this particular problem: while some studies suggest that teachers should wait until the students have attained a certain degree of proficiency with operating a word processor, others suggest that students gain mastery over a technology by putting it to use.

My study's data suggest that a crucial element in the successful use of a portable word processor for such purposes as brainstorming and composing is the degree to which the student feels comfortable engaging in keyboarding. If indeed such a skill level is crucial, then it may be reasonable to assume that the student will be more inclined to use the technology if he or she is more adept at using it. For those students who prefer using pencil because the tool is a more familiar one and they feel more confident using it, the keyboard of a portable word processor probably at first feels alien; however, given time

and experience, such hesitation usually diminishes and the act of keyboarding becomes second nature.

An implication for teaching might be best understood by changing the adage "writing improves with doing more writing" to "word processing improves with doing more word processing." To help develop student proficiency more quickly, the teacher could provide his or her students with both the opportunity to use their machines for whatever writing task is being undertaken and suggestions/instructions as to how the machine may be so employed. An important codicil to this suggestion is that the choice of which tool to use for writing should be decided by the students individually.

A further finding which has implications for teaching is that some students felt that if they had already been doing some keyboarding that day, in other words if their keyboarding fingers were "warmed up," then they would be more inclined to consider using their portable word processors when beginning to compose a work. If this is the belief of many students, then perhaps the classroom teacher might find it worthwhile to have the students do some brief task involving keyboarding so that the students would "warm up" to the idea of using their machines.

While the idea of comfort level is by now conventional wisdom, I feel that the latter finding merits further exploration. Will having a warm-up task be unobtrusive and facilitate the main objectives of the day's lesson?

The Role of Pen and Paper in Writing with a Portable Word Processor

Some studies have reported that writers using word processing alone engaged in significantly less planning, organization and focus. This suggests that reliance on word processing alone to assist with writing is not an effective choice; rather, using the technology in concert with pen and paper might effectively assist writers engaging in process writing. Some researchers have also suggested that a first draft should be handwritten. Some have also noted that during the act of composing, writers using pencil and paper made a variety of planning notes including content notes, structure notes, emphasis notes, and procedural notes, whereas those writing with a word processor tended to make mostly content notes. The research also suggests that for certain types of writing, such as narrative, students prefer writing with pencil and paper. The research seems far from unanimous concerning whether word processors or pencil and paper are the more effective tool when it comes to writers revising their work.

My study's data suggest that the introduction of a portable word processor in a classroom does not make pencil and paper obsolete, nor does it make their use prohibitive. The students observed in the study were very individualistic when it came to when and how they were using their WP-2 portable word processors. At different points in their

writing processes, some students reached for their machines while others opted for pencil and paper.

Most teachers would agree that such independent decision-making should be encouraged; however, as I discuss below, it is my impression that students may need to be shown the advantages of using a portable word processor for a particular part of a writing process before they can make an informed choice as to which tool to use.

Future research may wish to explore more closely what students do and do not understand about writing and what they do and do not understand about the ways in which they might use their portable word processors. Such inquiry could determine whether a correlation exists between such understandings and the degree to which the technology is being utilized.

The Effect of a Portable Word Processor on the Type of Writing

An obvious fact about the WP-2 portable word processor is this: it is a writing tool. It is a tool which has as its *raison d'être* to assist a writer with writing. As a writing tool, then, how might it assist students with what they must do most at school: how might it assist learning?

Recent research has shown that the act of writing (as distinguished from note taking) can assist students to apprehend course-related concepts. Much has been learned recently and continues to be learned about having students write in learning logs and dialogue journals. Even in classes which traditionally have not featured much writing, such as mathematics, dialogue journal writing is proving an effective means of helping students develop those skills involved with problem solving.

In the course of conducting my study at St. Ethos, I observed very few opportunities for writing in the Math 8 classes. On occasion, students were expected to take notes on mathematical concepts and processes, and a few did use their WP-2s for this purpose; however, I did not observe the students attempting anything which I would describe as "real" writing--writing in which the students were composing their thoughts concerning a mathematical concept. In their Science 8 classes, most of the writing which students did was also of a note-taking nature. Contrastingly, where I observed the most "real" writing being attempted was primarily in the Social Studies 8 and the Language Arts 8 classes, with some writing being attempted in the Science 8 classes.

It is my feeling that those classes where currently little or no writing is taking place might take advantage of the presence of portable word processing in their classrooms and profit from the use of writing as a means for students to make meaning. The adage "all teachers are teachers of writing" is one which I believe certainly may find a home in those

classrooms where students are walking in with word processors under their arms. The ease with which most of the students engaged in collaboration when writing and the public nature of the machine's text, especially when rendered as hardcopy, convince me that the portable word processor can assist in this area.

However, teachers must be knowledgeable not only about the portable word processor and its functions, but also about the nature of writing to learn. As some researchers have suggested, only by "retooling," will teachers be able to take advantage of the presence of the technology in their classrooms.

Future research might examine more closely than I did whether those classes whose students possess portable word processors do indeed take advantage of the technology and feature more frequent opportunities for the students to assist their learning through engaging in the act of writing. Such "writing to learn" could take the form of a dialogue journal or a learning log. Inquiry could also examine the effectiveness of the word processor compared with pencil and paper when it comes to attempting such writing. At present, there seems to be very little research which has examined this focus. As well, it would be interesting to find whether a word processor which is portable might be particularly effective at facilitating this type of writing.

The Impact of Teacher Understanding on the Use of the Portable Word Processor

An important part of answering what might be needed in schools to assist students in using the technology effectively is the instruction they receive. While the teachers at St. Ethos are a dedicated and hard-working group of professionals, the data I gathered from the teacher participants suggested that certain aspects of how the technology had been implemented at St. Ethos could stand improvement.

Teacher Understandings of the Technology

One of those aspects included an intensive orientating of teachers to the technology. The research contends that the implementation of computers into a writing classroom requires considerable preparation and planning, and that teachers need time for observation and reflection. Other than an afternoon visit to St. Cosmos Junior High to observe student use of WP-2s and an after-school inservice, it appeared that teachers had limited opportunities to reflect on and discuss the program prior to its implementation. As well, there appeared to have been few such opportunities during the school year. Several of the teachers commented to me that our interview sessions were valuable in that they provided an opportunity for such reflection and discussion.

Teacher Understandings of Writing

Besides focusing on the technology itself and looking at how it is introduced to both teachers and students, one might also examine the understanding which teachers have of those concepts which are integral to the technology. In the case of the WP-2, it is important to recognize the machine is a portable writing tool. One can then turn to and assess teacher understandings of writing.

Researchers have stressed what many teachers have long known from their experiences: writing is a complex matter. What some teachers also realize is that the nature of writing needs to be well understood by both those seeking to help those attempting to write.

I interpret the above statements to mean that, regardless of subject area, the better the classroom teacher apprehends the various writing processes and strategies from which a student might choose, the better he or she can assist the individual student to utilize portable word processing. As suggested earlier in this chapter, the idea of planning a paper using a word processor may have to be re-visioned: rather than viewing planning as a process which is completed during some prewriting "step," it may be more accurate to view planning as an ongoing process extending through the composing and revision stages as well. Even teachers' and students' ideas about composing and revising as "steps" in a writing process may need some redefining as the word processor continues to become a tool of choice in student writing and such precise "steps" become more blurred.

The data I gathered from the teacher participants suggested that two other aspects of how the technology had been implemented at St. Ethos are worth considering:

Orientating teachers to process writing using a portable word processor. In certain of our interview sessions, some teachers participants implied that instruction in writing was not one of their areas of expertise. A few of these teachers preferred encouraging the students to "run" with the technology and use it as it suited them best rather than giving them special writing instruction on how they might use the WP-2 for their various course-related writing tasks. The research suggests that students need to be shown what can be done with such a tool, how and when it might be employed most effectively, and the kinds of processes which may be involved.

Orientating teachers to the concept of writing to learn. When I discussed the feasibility of having students use their WP-2s for such writing as dialogue journals or learning logs, some of the teacher participants appeared to be unfamiliar with these types of writing. These were teachers who primarily assigned such writing tasks as essays or reports. Some of the other teachers appeared to be more familiar with the concept of writing to learn. A few offered ideas on how a portable word processor could assist

students with attempting writing which assisted their learning. For example, Ms. Norris described how the machine might lend itself to the writing of dialogue journals in various courses including math.

Some of the teachers who remarked during our interview sessions that there were aspects of writing and word processing with which they were not very familiar expressed a desire to learn more. In the course of our interviews, a few even began speculating on how they might rethink some of their assignments and teaching strategies.

The Importance of Inservicing and Time for Program Needs

The above findings and conclusions concerning how portable word processors were implemented at St. Ethos led me to one further aspect:

Sustained administrative support. While the administration at St. Ethos demonstrated a strong commitment to the program and was knowledgeable about how it was functioning, there appeared to be an absence of on-going inservice opportunities designed to be responsive to the needs of those teachers who were charged with the task of implementing the program. As Levin (1990) noted, without such opportunities it is difficult for a staff to develop a clear vision of computer use and a plan for change.

My thoughts on these findings are that the implementation of a new technology such as portable word processing into the school setting should be undertaken with considerable care and clear intent. Teachers who are considering implementing portable word processors into their programs may find that it is very important that they lobby for time to become familiar with the technology and its possible impact on student writing and learning, and to lobby for on-going inservice opportunities wherein they can meet with other teachers and discuss their experiences.

Future research might find it fruitful to concentrate more thoroughly than did this study on how portable word processing is implemented in schools. An interesting emphasis would be to include teacher narratives of how they are responding to the presence of the technology in their classrooms. As well, their assessment of how well they have been orientated to the technology, how well they were inserviced about process writing and writing to learn, and how well they were provided with on-going inservicing would be meaningful. Illumination of these concerns would make more complete our understanding of how portable word processors may be utilized most effectively by students at this grade.

Future research could also look at the paradigms concerning writing embraced by teachers whose students have portable word processors and explore whether, in the course of working with students using such machines, a paradigm shift occurs. I would speculate that interrelated with such paradigms are attitudes towards writing, attitudes which might impact on the degree and nature of instruction which teachers provide to their students. I

wonder too whether the choice of some of the teachers at St. Ethos to leave the word-processing strategies up to the students may have been compounded by the presence of a new writing technology.

Concluding Remarks

As a recent technology, the portable word processor promises to have an increasing effect on the teaching and learning which will occur in our classrooms. As I stated at the beginning of my thesis, it is a technology which will not be denied. We will see its presence in our classroom at an increasing rate.

In my opinion, the portable word processor seems to be well-suited to assist with collaborative and process writing, and may enhance positive student attitudes towards writing and sharing written work publicly. An important part of the successful use of portable word processors appears to be the the number of printers available in the classroom. As well, the accessibility of those printers is important, and requires understanding on the part of teachers that students may need to print hardcopies of their work at point in their writing processes.

If its presence in classrooms is acknowledged and understood, such a technology promises to have considerable effect on the teaching and learning that will transpire. As well, the portable word processor promises to provoke a number of questions and concerns which teachers have not had to ask or deal with previously.

Not least of these will be questions and concerns about the democratic nature of public schooling. What are we as educators to do if some, but not all of our students are bringing the machines into our classes and have access to them? Will those who are economically advantaged be denied the right to bring such a tool into their learning environments? Will those who cannot afford to buy such machines (or prefer not to) be at a disadvantage? Will schools have to provide machines for all?

Similar questions were asked when the ballpoint pen made its first appearance. The electronic calculator, as well, provoked much wringing of hands. Will the portable word processor follow a similar path?

In spite of the problems and difficulties and issues which must be addressed with the arrival of what is really just another writing tool, the portable word processor may be the answer to the long-enduring problem of machine access. Mohammed need not journey to the mountain, for the mountain will come to Mohammed: instead of students journeying to a computer writing lab, the 'lab' will rest on their laps.

The challenge for forward-thinking teachers may be not so much to undertake the task of understanding the nature and the advantages of such a technology; rather, to take advantage of the potential offered by portable word processors to assist student learning, they may have to reassess their understandings and methodologies. To facilitate such adaptation, teachers must be provided with the means by which to embrace those shifts in paradigm and to initiate those changes to instruction which the arrival of the technology will undoubtedly provoke. Given such means, the possibility of change may increase and the promise of the portable word processor might be realized more fully.

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APPENDICES

APPENDIX 1
PERMISSION LETTERS

Permission Letter--All Students

Please keep this letter for your records.

Dear Parent/Guardian:

I am a teacher who is now studying at the University of Alberta. From the latter part of April to the end of May I will be at St. Ethos Junior High School to do a research study. The study will examine the use of portable word processors by classes 8X and 8Y.

I will be observing students as they go about their normal routines in math, science, language arts, social studies and computers. Twice during the study I will have students respond to in-class questionnaires which will examine their writing habits and their use of Tandy WP-2 word processors.

This research study has been approved by my advisor, Dr. John Oster, by the University of Alberta, by the Testing and Research Coordinator (ECSD), and by Mr. Boris Redfern, principal at St. Ethos School.

For my research to be successful, I hope to have most students in classes 8X and 8Y participate in the study. I request your permission for your child to take part in this study. I am also seeking your child's permission to include him/her in the study. A bit later in the study I will seek permission for four students to participate as key contributors.

The identities of all participants will be concealed; anonymity is assured.

If for any reason it becomes necessary, your child may withdraw from the study at any time.

Thank you for taking time to complete the form below. I appreciate your cooperation. Should you have any questions, please feel free to contact me at St. Ethos School [phone number] or at the University of Alberta [phone number].

Yours sincerely,
Cameron C. Fahlman

I (do, do not) give permission for my child, _____, to participate in the study to be done by Cameron Fahlman at St. Ethos School.

I (do, do not) consent to be included in the study to be done by Cameron Fahlman at St. Ethos School.

_____
Signature of Parent or Guardian

_____
Signature of Student

Please tear off and return the permission statement by April 24. Thank you.

Permission Letter--Student Key Informants

Please keep this letter for your records.

Dear Parent/Guardian:

Thank you for granting permission for [Name] to participate in my study of the use of portable word processors by classes 8X and 8Y at St. Ethos Junior High School.

As I indicated previously, I have been observing students as they go about their normal routines in math, science, language arts, social studies and computers. The students recently completed in-class questionnaires, and they are answering my questions about what they are doing with the Tandy WP-2 word processor.

To assist me further in my research, I want to observe, interview and read the writing of eight student participants. These eight students will be "key informants" who will provide in-depth data for my study. To provide a clearer picture of impressions and attitudes concerning your child's use of a portable word processor, I also want to interview some of the parents of the key informants.

I request your permission for your child to participate as a **key informant** in this study. I am also seeking your child's consent to participate in this manner.

As I mentioned earlier, the identities of all participants will be concealed; anonymity is assured. If for any reason it becomes necessary, any participant may withdraw from the study at any time.

Thank you for taking time to complete the form below. I appreciate your cooperation. Should you have any questions, please feel free to contact me at St. Ethos School [phone number] or at the University of Alberta [phone number].

Yours sincerely,
Cameron C. Fahlman

---------- please tear here & return ----------

I (do / do not) give permission for my child, ..., to participate as a key informant in the the study being done by Cameron Fahlman at St. Ethos School.

I (do / do not) consent to participate as a key informant in the study being done by Cameron Fahlman at St. Ethos School.

_____
Signature of Parent or Guardian

_____
Signature of Student

APPENDIX 2
GENERAL QUESTIONNAIRES

Note: For the purposes of economy, I have reduced the amount of space which originally had been provided for students' responses.

STUDENT SURVEY #1
ST. ETHOS JUNIOR HIGH SCHOOL

Student's Name _____

Class _____

This questionnaire is part of a study being conducted on the impact of word processors on student writing at St. Ethos School. It seeks information from those students using Tandy WP-2 portable word processors in their grade eight core subjects.

- For most questions, a ✓ is all that is needed.
- For some questions, a brief discussion is requested.

Please read carefully and respond completely.

PART A

1) Do you have access to a computer at home? ____ YES ____ NO
If you answered YES, please give the number of computers at home: ____

2) Do you ever work on any school-related writing
on a home computer? ____ YES ____ NO
If you answered YES, please indicate with a ✓
how often you use it for school-related writing:
__ very frequently __ frequently __ sometimes __ seldom

3) Do you ever download your Tandy WP-2
onto a home computer? ____ YES ____ NO
If you answered YES, please indicate with a ✓
how often you download your work:
__ very frequently __ frequently __ sometimes __ seldom

4) Do you have access to a printer at home? ____ YES ____ NO
If you answered YES, please indicate with a ✓
how often you use it to print a hardcopy of your work:
__ very frequently __ frequently __ sometimes __ seldom

PART B

1. With a ✓ please complete the following phrase:
When I write, I prefer using ____ a word processor
____ pen and paper

If you checked a word processor, please complete **A**.
If you checked pen and paper, please complete **B**.
If you checked both of them, please complete **A** and **B**.

A. You prefer writing with a word processor. Please discuss different situations when and various reasons why.
WHEN: _____
_____

WHY: _____

_____

B. You prefer using pen and paper. Please discuss different situations when and various reasons why.

WHEN: _____

_____

WHY: _____

_____

2) Do you use your Tandy WP-2 for both writing and note-taking? ____ YES ____ NO

If you answered YES, please estimate what percentage of the time you use the WP-2 for these different tasks:

writing _____ % note-taking _____ % other _____ %

3) Do you find that the Tandy WP-2 attracts you to use it for writing? ____ YES ____ NO

Please discuss reasons for your response: _____

_____

_____ . . .

Thank you for taking the time to respond to this questionnaire.

STUDENT SURVEY #2
ST. ETHOS JUNIOR HIGH SCHOOL

Student's Name _____

Class _____

This questionnaire is part of a study being conducted on the impact of word processors on student writing at St. Ethos School. It seeks information from those students using Tandy WP-2 portable word processors in their grade eight core subjects.

Please read carefully and respond completely.

Responses which are specific and detailed will assist the study greatly.

1) There are times when students prefer writing with pen and paper, and times when students prefer using a word processor. Please reflect on your own preferences.

At times you may prefer writing with pen and paper. Please describe different situations WHEN and discuss reasons WHY.

_____

_____

_____

_____ . . .

At times you may prefer writing with a word processor. Please describe different situations WHEN and discuss reasons WHY.

_____

_____

_____

_____ . . .

2) Do you find that the Tandy WP-2 makes writing easier?

YES ____ NO ____ SOMETIMES ____

Please discuss reasons for your response:

_____

_____

_____

_____ . . .

3) Please offer anything else you would like to tell me concerning your use of the Tandy WP-2.

_____

_____

_____

_____ . . .

Thank you for taking the time to respond to this questionnaire.

APPENDIX 3
SELECTION QUESTIONNAIRE

Selection Questionnaire--Key Informant Candidates

Dear [Student's Name]:

As you probably know, I am looking for a small number of students to serve as "key informants"--students who will provide in-depth information for my study about the use of a portable word processor in their writing process. I am considering you as one of these main participants.

Please assist me in making my selection. I need an indication of how well certain students respond to the following questions. Please reflect on each question, weigh how you would like to answer it, and write down a response.

1. Please describe for me how you might typically go about writing a composition for language arts or social studies.
2. How might your use of the Tandy WP-2 portable word processor be typical of how the machine is used by grade eight students in your school?
3. How might your use of the Tandy WP-2 be different from how it is used by your peers?
4. What do you think you might be able to contribute to this study which is important for those who are wondering about the impact of a portable word processor on writing and learning?

Thank you for your effort in answering these questions.

APPENDIX 4
STUDENT KEY INFORMANT QUESTIONNAIRES

Note: All four questionnaire sections, Parts A through D, were given to key informants to take home and complete. The students were asked to return the completed questionnaires within a week's time.

For the purposes of economy, I have reduced the amount of space which originally was provided for students' responses.

STUDENT KEY INFORMANT SURVEY
ST. ETHOS JUNIOR HIGH SCHOOL

Student's Name _____

Class _____

PART A: Collaboration

This questionnaire is part of a study being conducted on the impact of word processors on student writing at St. Ethos School. It seeks information from those students who are acting as key informants concerning their use of portable word processors in their grade eight core subjects.

Please read carefully and respond completely.

Responses which are specific and detailed will assist the study greatly.

Collaboration: when one person assists another to get something done.

1) When you are writing, do you sometimes offer assistance to or ask for assistance from another student?

_____ YES _____ NO

If you answered YES, please describe:

- When? (for what types of writing / at what stage(s) of your writing?)
- Why? (what assistance is being asked for?)
- How? (describe what occurs during such collaboration)

WHEN:

_____

WHY:

_____

HOW:

_____

Need more room? Use back of page.

2) Does the Tandy WP-2 encourage collaboration? ____ YES ____ NO

Please discuss reasons for your response: _____

Need more room? Use back of page.

3) Compared with a tabletop computer (e.g. an Apple IIe or a Macintosh) how much does the Tandy WP-2 portable laptop computer encourage collaboration?

_____ More _____ As Much _____ Less

Please discuss reasons for your response: _____

_____

Need more room? Use back of page.

STUDENT KEY INFORMANT SURVEY
ST. ETHOS JUNIOR HIGH SCHOOL

Student's Name _____

Class _____

PART B: Planning

This questionnaire is part of a study being conducted on the impact of word processors on student writing at St. Ethos School. It seeks information from those students who are acting as key informants concerning their use of portable word processors in their grade eight core subjects.

Please read carefully and respond completely.

Responses which are specific and detailed will assist the study greatly.

Planning: categorizing, organizing, and structuring the sequence of your thoughts

1) Concerning your own writing, please describe WHEN & HOW you plan.

_____

Need more room? Use back of page.

2) In your opinion, does the Tandy WP-2 encourage planning? YES ___ NO ___

Please discuss reasons for your response: _____

_____

Need more room? Use back of page.

3) Compared with pen and paper or a tabletop computer how much does the Tandy WP-2 portable laptop computer encourage planning?

_____ More _____ As Much _____ Less

Please discuss reasons for your response: _____

_____

STUDENT KEY INFORMANT SURVEY
ST. ETHOS JUNIOR HIGH SCHOOL

Student's Name _____

Class _____

PART C: Revision

This questionnaire is part of a study being conducted on the impact of word processors on student writing at St. Ethos School. It seeks information from those students who are acting as key informants concerning their use of portable word processors in their grade eight core subjects.

Please read carefully and respond completely.

Responses which are specific and detailed will assist the study greatly.

Revision: Changing something by means of adding, taking away, moving, or changing.

1) Concerning your own writing, please describe WHEN & HOW you revise.

_____

_____

Need more room? Use back of page.

2) In your opinion, does the Tandy WP-2 encourage revision? YES ___ NO ___

Please discuss reasons for your response: _____

_____

Need more room? Use back of page.

3) Compared with pen and paper or a tabletop computer how much does the Tandy WP-2 portable laptop computer encourage revision?

_____ More _____ As Much _____ Less

Please discuss reasons for your response: _____

_____

STUDENT KEY INFORMANT SURVEY
ST. ETHOS JUNIOR HIGH SCHOOL

Student's Name _____

Class _____

PART D: Hardcopies

This questionnaire is part of a study being conducted on the impact of word processors on student writing at St. Ethos School. It seeks information from those students who are acting as key informants concerning their use of portable word processors in their grade eight core subjects.

Please read carefully and respond completely.

Responses which are specific and detailed will assist the study greatly.

You print **hardcopies** of your writing for various reasons.

- When? (if possible, describe at least three different instances).
- Why? (describe what you do with the hardcopy).

WHEN:

_____

_____

_____

WHY:

_____

_____

_____

Need more room? Use back of page.

Thank you for taking the time to respond to this questionnaire.

APPENDIX 5
SPELLING CHECKER QUESTIONNAIRES

Note: For the purposes of economy, I have reduced the amount of space which originally had been provided for students' responses.

SPELLING CHECKER SURVEY #1

Your Tandy WP-2 has a built in spelling checker. I am interested in learning WHEN and HOW you are using it, and whether or not it helps you become a better speller.

1) WHEN do you use the spelling checker? (try to think of at least two different instances/situations when you may use it)

2) HOW do you use it?

3) Has it helped you become a better speller? Please discuss.

. . . . . .

SPELLING CHECKER SURVEY #2

I wish to learn something further about how a built-in spelling checker has affected your writing.

1) Please respond to the following statement:

"Using a word processor with a built-in spelling checker has encouraged me to use difficult-to-spell words in my writing."

Strongly Agree ___ Agree ____ Neutral ___ Disagree ___ Strongly Disagree ___

Please discuss your response:

2) Please offer any additional comments about how the built-in spelling checker has/hasn't affected your writing.

3) How would you rate your ability to spell?

Very strong ___ Strong ____ Average ___ Weak ___ Very weak ___

. . . . . .

SPELLING CHECKER SURVEY #3 (Students: Please Circulate)

I would like to learn what sorts of words you have added to your user dictionary. Please jot down the words which you have "taught" your spelling checker. Or tell me if you haven't added any or if you did not know you could add words.

Name User Dictionary Words

APPENDIX 6
SPELLING CHECKER FUNCTIONS ON THE TANDY WP-2

Auto spell check

The Auto spell check is used when the writer wants the WP-2 to beep each time he or she types a word which the machine does not recognize. To turn the spelling checker on, the writer runs the Setup program and uses [fl] to scroll to where **Auto spell check** appears on the screen. The writer than uses the [‹] to highlight YES.

Spellword

The Spellword function is used to check the spelling of a single word. To activate the function, the writer simply moves the cursor to any letter within the word which is to be checked and presses **[F1]-[6]**. The program then scrolls through the text.

If the word is found in the machine's built-in dictionary or the user dictionary, the writer sees the prompt **Correct spelling** at the bottom of the screen. The writer then presses **[Cncl]** and continues writing.

If the program does not recognize the word, it may list some alternate spellings. If necessary, the writer may use the [fl] key to view the entire list. To select a word from the suggested list, the writer moves the cursor to that word and presses **[Enter]**. The chosen word then replaces the one originally highlighted.

If the program does not recognize the word, it may not suggest any alternate spellings and the prompt **Not found** will appear.

Spelldoc

The Spelldoc function is used to check the spelling of an entire piece of writing. To activate the function, the student simply presses **[F2]-[6]**. The program then scrolls through the text.

If all the words are found in either the built-in dictionary or the user dictionary, the student sees the prompt **Correct spelling** at the bottom of the screen, and the student continues writing.

If the program finds a word which it determines is misspelt or unknown, it highlights the word in question and a menu offering four options appears on the screen. The options are:

1. "Skip." If the writer wishes to skip the highlighted word, he presses **[S]** and the program advances to the next questionable word.

2. "Edit." If the writer wishes to change the word in some way, he or she presses **[E]**. The prompt **CHANGE TO?** appears on the screen, and the writer types in a correction then presses **[ENTER]**, and the highlighted word is replaced with the correction.

3. "Correction." The writer presses **[C]** to elicit a list of alternate spellings of the highlighted word. By using the [fl] key, the writer may view the entire list from which to choose the correct word. By moving the highlight bar to the desired word and pressing **[ENTER]**, the writer completes the correction.

4. "Add to dict." If the writer wants the WP-2 to learn the highlighted word by adding it to the user dictionary, he or she presses **[A]**. When the prompt **ADD (Yes/No)?** appears on the screen, the writer presses **[Y]** to add the word to the user's dictionary.

User's Dictionary

The Tandy WP-2 portable word processor has a built-in dictionary which is expandable: a user may add words which are not part of the machine's everyday vocabulary and access this specialized vocabulary through either the Spellword or Spelldoc functions. During the second week of my study, I asked the students what sorts of words they had been adding to their user's dictionaries [see Appendix 5].

I learned that some additions were for purposes of practicality:

- significant names (student's own name, etc.)
- Canadian spellings (centre, labour)
- the English alphabet (small and capital letters)
- abbreviations: months of the year (Jan., Feb., etc.)
- abbreviations of metric measurement (cm, g, ml, etc.)
- and other abbreviations (Co., Dr., gov't, 1st, subj., p.)

I learned as well that some students also added subject-specific vocabulary:

- names of historical figures (Garneau, Notley, Riel)
- terminology (Metis, chloroplasts, H_20)

Some students commented that they had been adding words to their user's dictionary throughout the school year, but they had lost most of those words because the cursor on their WP-2s "froze" on them and they had to turn the whole machine off (thereby losing all RAM).

Some words which I thought would have been on the machine were not and had to be added: eg. ploughing, suffrage, tillage.

Interestingly enough, when I asked the two classes to tell me about the kinds of things they were adding to the User Dictionaries, there were at least a couple students in each class who had not known that there was such a feature in their machines. The WP-2 Portable Word Processor Owner's Manual explicitly describes the process for adding to and viewing the contents of the user's dictionary file.

APPENDIX 7
INTERVIEW QUESTIONS

Note: The purpose of these lists of questions was to provide a "scaffolding" for the scheduled oral interviews. Questions asked did not follow a set order. For the key informant interviews, I took information from the students' responses to the various questionnaires and recorded it onto the question sheets to serve as a "springboard" for further elaboration.

Interview Questions--Student Key Informants

- I am interested in learning about your experience with word processing.
  Describe your experience using word processing - home
  - school
  - WP-2
- You have / haven't a home computer? You have / haven't a printer?
- You rate your keyboarding (Questionnaire 1) as _____.
- When I say the term "writing process," what do you picture?

  NB: The following questions concern *writing* (not note-taking).
- You responded that you used the WP-2 for certain tasks (Questionnaire 1).
  Describe for me the kinds of writing you have been doing this year in gr. 8.
  -- L.A., Social, Science, Math, Computers, French....
- How do you feel about the types of writing tasks?
- How do you feel about the number of writing tasks you have done?
- How do you feel about the amounts of writing you have been doing?
- You responded (Questionnaire 2) there are times when you may prefer writing with pen and paper (go over comments).
- You responded (Questionnaire 2) there are times when you may prefer writing with a word processor (go over comments).
- When I asked whether you find that the WP-2 makes writing easier (Questionnaire 2), you said _____.

You commented:_____

- I am interested in learning about what the act of writing means to you.
  What happens when you write something like an essay?
  What about other types of writing?
- Does the writing tool--using a pen & paper or word processor--affect what happens?
- What have your experiences with writing taught you about writing?
- You responded earlier (Questionnaire 1) that "to have access to a word processor" was _____ to you. Why?
- You responded that constant accessibility was _____ to you because

_____

(Elaborate...)

- You responded that portability was _____ to you because

_____

(Elaborate...)

• When asked (Questionnaire 1) if using a word processor has helped you write better, you responded _____. What makes you think that?

• Concerning the use of spelling checkers you have commented:
WHEN:

_____

HOW:

_____

• When asked whether it has "helped you become a better speller" you commented:

_____

• When asked if it has encouraged you "to use more difficult-to-spell words" in your writing, you answered _____ and commented:

_____

• In your "key informant survey" you offered the following comments:

. . . . . .

[The following was for my use only. It was a template which assisted my questioning.]
COLLABORATION (QUESTIONNAIRE A): (offered? ___ YES, ___ NO;
___ pen, ___ tabletop, ___ WP-2)

WHEN:
WHY:
HOW:

When asked (Questionnaire A) whether the WP-2 makes it easy to collaborate:
___ YES, ___ NO
... compared with pen, you said (Questionnaire A) _____.
... compared with a tabletop, you said (Questionnaire A) _____.

PREWRITING (Questionnaire B)
REVISION/EDITING (Questionnaire C)
HARDCOPY (Questionnaire D)

Interview Questions--Teacher Participants

In preparation for our interview session next week, please look over the following interview questions. If you have any questions or concerns, please do not hesitate to speak with me.

- Could you describe the Grade 8 Program of Studies for your course? What content does it cover?
- What are some of the concepts which are taught?
- What are some of the skills?
  - -- Aside from note-taking skills, what writing skills are taught / reinforced?
- What types of writing do grade eight students attempt in your course?
  - -- essay (what types: argument, summary, description, ...)
  - -- role-playing (persona)
  - -- learning logs or journal
- What observations can you offer about the writing products which the grade eight students have been producing?
  - -- content / development (main focus, supporting ideas, etc.)
  - -- organization (coherence, logical progression, etc.)
  - -- sophistication of style (choices in diction, sentence effectiveness, etc.)
  - -- conventions (spelling, punctuation, grammar)
- What observations can you offer about the writing processes which the grade eight students have been demonstrating?
  - -- planning
  - -- collaboration
  - -- revision
- How important a role does writing (as opposed to note-taking) play in your grade eight course?
- How comfortable are you with your knowledge and understanding of the role which writing might play in connection with student learning?
  - -- How has that knowledge and understanding been improved during your teaching career?
  - -- In your opinion, could it be improved further? should it? how might it?
- How would you describe your experience (involvement) with students using
  - -- word processing in general?
  - -- the Tandy WP-2 portable word processor?

- How comfortable are you with your knowledge and understanding of word processing -- in general?
  -- the WP-2 specifically?
- In what ways has the presence of the word processing tool in your classroom affected how you have taught your grade eight course?
- You have experienced the presence of this technology in your classes for most of this school year. If this school were to again assemble grade eight classes consisting of students with WP-2 portable word processors, what might you as a teacher do differently in next year's grade eight class?
- How was the whole question of the WP-2 at your school -- introduced?
  -- implemented?
  -- supported?
  -- evaluated?
- In your opinion, how might these stages have been/be improved?
- In your opinion, in your classes has the WP-2 as a writing tool helped student writing?
- Concerning your observations of students' experiences with using the WP-2
  -- What sorts of things have contributed to the successful use of this tool?
  -- What sorts of things have interfered with such successful use?
- In your opinion, in subsequent years how might students in Grade 8 experience greater success with using the WP-2 as a tool to assist their writing?
- Are there any further comments, concerns, or questions you would like to offer?

APPENDIX 8
STUDENT TRANSCRIPT COVER LETTER

Dear [Student's Name]:

I am giving you two copies of the transcript of our [date of session] interview session:

One copy is for you to keep. In order for my study to be as ethical as possible, I want whoever participated in it to know what I think I heard them say to me.

The other copy is for you to return to me. Please read over one of the copies and check it for accuracy. Were you understanding things clearly? Were you answering the way in which you wanted to? Did you say what you wanted to say? At times I have indicated NB where some problems may persist.

Please feel free to write on the transcript, adding, deleting, changing what you wish. This does not invalidate the interview in any way. In fact, it may make it more valid. If you have any questions/concerns, please phone me at home at [phone number].

Could you please return this second copy to the General Office at your earliest convenience? I have told the secretaries there that I am expecting something to be handed in by my key informants during the next week or so. If I have not received this back from you toward the end of next week, I will contact you.

Thank you for your considerable time in helping to make my study a very significant examination of an interesting and timely phenomenon. The voices of my key informants are a most important aspect of my study.

Thank you once again!

Sincerely,

Cameron C. Fahlman

APPENDIX 9
PERMISSION LETTER (TANDY)

INTERTAN BUSINESS PRODUCTS DIVISION OF INTERTAN CANADA LTD. TANDY COMPUTERS

Cameron C. Fahlman
31 Fairway Drive
Edmonton, Alberta
T6G 2G5

RE: "Permission to Publish"

Dear Mr. Fahlman,

As indicated in our conversation earlier this month, granting permission for publishing printed WP-2 information from brochures, Teacher In-Service Manual and WP-2 Owners Manual has been given to you. Please accept this letter as written permission.

Should it be acceptable to you and your professors, InterTAN would appreciate permission from you to obtain a transcript of your completed thesis and use it for promoting the WP-2 Process Writing in Motion project. Your thesis represents the only objective study of this particular product and its applications in classroom education and as such would be instructive to educators implementing the project.

InterTAN wishes you every success with your thesis and if I can be of any assistance in terms of additional information, please contact me at 486-2777.

Sincerely,

Robert I. Gilmour
Regional Education Coordinator
RG/rig

APPENDIX 10
HARDWARE SPECIFICATIONS OF THE TANDY WP-2 PORTABLE WORD PROCESSOR

Word Processor:	Built in expandable100,000 word dictionary; thesaurus
Display:	80-column x 8 line liquid crystal display (LCD)
Memory:	256 ROM (contains the word processing program, spelling checker, and thesaurus) 32K (10 ROM, 22 RAM); expandable to 54 K RAM (32 K RAM chip upgrade) Expansion card slot for 32K RAM memory cards NB: The WP-2 can be connected to a portable disk drive
Processor:	8-bit, Z80-type CPU with 5.5296 MHz clock speed
Keyboard:	Full-size, 62-key
Input/Output:	Parallel printer interface, RS-232C serial interface (for disk drive and modem), cassette recorder interface
Weight:	1.4 Kilograms (3.1 pounds)
Dimensions:	298 mm x 216 mm x 25.4 mm
Power:	Four "AA" batteries or optional AC adapter CR2430 lithium internal backup battery
Communications:	Optional 1200-bps/2400-bps external portable modems (the WP-2 offers direct ASCII transfer (at 300-9600 Baud, 8-Bit words,1 Stop Bit, no parity, line feed enabled)

Sources: Tandy WP-2 brochure (InterTAN Business Products) and WP-2 Portable Wordprocessor Owner's Manual